

SPECIFICATION
NO. TTF-1
6 October 1966

CONSTRUCTION SPECIFICATION

FOR

TRANSMITTER FACILITIES

25X1A

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SECTION GC - GENERAL CONDITIONS

GC.1 Definitions:

- (a) The Contract Documents shall consist of the Agreement, the Drawings and Specifications, including all modifications thereof incorporated in the documents before their execution.
- (b) Owner: Government of the United States of America, hereinafter referred to as Government, the Contractor and the Contracting Officer are those mentioned as such in the Agreement.
- (c) Wherever in this Contract the name "Contracting Officer" it shall be understood as referring to the Contracting Officer of the Government, acting personally or through his duly authorized representative.
- (d) The term work includes labor or materials or both, equipment, transportation, or other facilities necessary to complete the Contract.

GC.2 Specifications and Drawings: The Contractor shall keep at the project site a copy of the drawings and specifications and shall at all times give the Contracting Officer access thereto. Anything mentioned in the specifications and not shown on the drawings, or shown on the drawings and not mentioned in the specifications, shall be of like effect as if shown or mentioned in both. In case of difference between drawings and specifications, the specifications shall govern. The intention of the documents is to include all labor, tools, materials, equipment, services and transportation necessary for the proper execution of the work. In case of discrepancy either in the figures, in the drawings, or in the specifications, the matter shall be promptly reported to the Contracting Officer, who shall promptly make a determination in writing.

GC.3 Ownership of Drawings and Specifications: All drawings and specifications are the property of the Government and are not to be used on any other work.

GC.4 Contractor's Understanding: It is understood and agreed that the Contractor has, by careful examination, satisfied himself as to the nature and location of the work, the character, quality and quantity of materials, the

character of equipment and facilities needed for the prosecution of the work, the general and local conditions, and all other matters which can in any way affect the work under this Contract. No verbal agreement or conversation with any officer, agent or employee of the Government, either before or after the execution of this contract, shall affect or modify any terms or obligations herein contained.

GC.5 Protection of Work and Property: The Contractor shall continuously maintain adequate protection of all his work from damage and shall protect the Government property from injury or loss arising in connection with this Contract. The Contractor shall make good any such damage, injury or loss, except as may be directly due to errors in the Contract Documents or caused by agents or employees of the Government.

GC.6 Inspection of Work: The Contracting Officer and his representatives shall at all times have access to the work wherever it is in preparation or progress and the Contractor shall provide proper facilities for such access and for inspection.

GC.7 Contractor's Supervision: The Contractor shall keep on the work during its progress a competent superintendent and any necessary assistants, all satisfactory to the Contracting Officer. The superintendent shall not be changed without consent of the Contracting Officer, unless the superintendent leaves the employ of the Contractor. The superintendent shall represent the Contractor in his absence and all directions given to him shall be as binding as if given to the Contractor. Important directions shall be confirmed in writing to the Contractor. The Contractor shall give efficient supervision to the work, using his best skill and attention.

GC.8 Changes in the Work: The Government, without invalidating the Contract, may order extra work or make changes by altering, adding to or deducting from the work, the Contract Sum being adjusted accordingly. All such work shall be executed under the conditions of the original Contract except that any claim for extension of time caused thereby shall be adjusted at the time of ordering such change. In giving instructions, the Contracting Officer shall have authority to make minor changes in the work, not involving extra cost, and not inconsistent with the purposes of the work, but otherwise, except in an emergency endangering life or property, no extra work or change shall be made unless in pursuance of a written order by the Contracting Officer,

and no claim for an addition to the Contract Sum shall be valid unless so ordered. The value of any such extra work or change shall be determined by one of the following ways:

- (a) By estimate and acceptance in a lump sum.
- (b) By unit price agreed upon between the Contracting Officer and the Contractor.

GC.9 Claims for Extra Cost: If the Contractor claims that any instructions by drawings or otherwise involve extra cost under this Contract, he shall give the Contracting Officer written notice thereof within 10 days after the receipt of such instructions, and in any event before proceeding to execute the work, except in emergency endangering life or property, and the procedure shall then be as provided for changes in the work. No such claim shall be valid unless so made.

GC.10 Deductions for Uncorrected Work: If the Contracting Officer deems it inexpedient by other means to correct work injured or done not in accordance with the Contract, an equitable deduction from the Contract price shall be made therefor.

GC.11 Delays and Extension of Time: If the Contractor be delayed at any time in the progress of the work by any act or neglect of the Government or of his employees, or by any other Contractor employed by the Government, or by changes ordered in the work, fire, unusual delay in transportation, or by any cause which the Contracting Officer shall decide to justify the delay, then the time of completion shall be extended for such reasonable time as the Contracting Officer may decide.

GC.12 Correction of Work Before Final Payment: The Contractor shall promptly remove from the premises all materials condemned by the Contracting Officer as failing to conform to the Contract, whether incorporated in the work or not, and the Contractor shall promptly replace and re-execute his own work in accordance with the Contract and without expense to the Government and shall bear the expense of making good all work of other contractors destroyed or damaged by such removal or replacement.

GC.13 Suspension of Work: The Government may at any time suspend the work, or any part thereof by giving two (2) days notice to the Contractor in writing. The work shall be resumed by the Contractor within seven (7) days after the date fixed in the written notice from the Government to the Contractor to do so. The Government shall reimburse the Contractor for expense incurred by the Contractor in connection with the work under this contract as a result of such suspension. But if the work or any part thereof shall be stopped by notice in writing aforesaid, and if the Government does not give notice in writing to the Contractor to resume work

at a date within sixty (60) days of the date fixed in the written notice to suspend, then the Contractor may abandon that portion of the work so suspended and he will be entitled to payment for all work done on the portions so abandoned, if any.

GC.14 As-Built Changes made during construction shall be recorded by the Contractor on reproducible prints and forwarded to the Contracting Officer at the completion of the contract.

GC.15 Government's Right to Do Work: If the Contractor should neglect to prosecute the work properly or fail to perform any provision of this Contract, the Government, after three days written notice to the Contractor, may, without prejudice to any other remedy he may have, make good such deficiencies and may deduct the cost thereof from the amount then or thereafter due the Contractor.

GC.16 Use of Complete Portions: The Government shall have the right to take possession of and use any completed or partially completed portions of the work in accordance with the completion schedule, notwithstanding the time for completion of the entire work but taking possession and use shall not be deemed an acceptance of any work not completed in accordance with the Contract Documents. If such prior use increases the cost or delays the work, the Contractor shall be entitled to such extra compensation, or extension of time, or both, as the Contracting Officer may determine.

GC.17 Indemnity: The Contractor shall indemnify and save harmless the Government from and against all losses and all claims, demands, payments, suits, actions, recoveries and judgments of every nature and description brought or recovered against him, by reason of any act or omission of the said Contractor, his agents or employees, in the execution of the work or the guarding of it.

GC.18 Separate Contracts: The Government reserves the right to let other contracts in connection with this work. The Contractor shall afford other Contractor's reasonable opportunity for the introduction and storage of their materials and the execution of their work. Wherever work being done by the Government forces or by other contractors is contiguous to work covered by this Contract, the respective rights of the various interests involved shall be established by the Contracting Officer to secure the completion of the various portions of the work in general harmony.

GC.19 Contracting Officer : The Contracting Officer shall have general supervision and direction of the work. He has authority to stop the work whenever such stoppage may be necessary to insure the proper execution of the Contract. He shall also have authority to reject all work and materials which do not conform to the Contract, to direct the application of forces to any portion of the work, as in his judgement is required, and to order the force increased or diminished.

GC.20 General Intention: It is the declared and acknowledged intention and meaning to provide and secure complete and ready for use the new construction described on the accompanying drawings and these specifications.

GC.20.1 General Description: The work includes providing of the following:

I. Site Improvement:

- | | |
|---|--------------|
| a) Earth Fill | 43,810 cu.m. |
| b) Clearing and Grubbing | 75 Acres |
| c) Chain Link Fence, 8-Ft. high w/gates | 250 m. |
| d) Access road and Parking | |
| Double Bituminous Surface Treatment | 1,670 sq.m. |
| e) Walkway | 2,400 sq.m. |
| f) Barbed Wire Fence | 2,681 m. |
| g) Wooden Fence | 254 m. |

II. Structures:

- a) Transmitter building, approximately 12 meters, by 22 meters reinforced concrete frame with masonry partitions, air-conditioning plumbing electric power including cable trays and ground system, except equipment installation.
- b) Generator building, approximately 8 meters by 18 meters reinforced concrete frame with masonry partitions, including installation of government furnished generators, government-furnished switchgear, with ground system and electrical connections to transmitter building.
- c) Gate House 2.10 meters by 2.10 meters and security lighting.

- d) Elevated Water Storage Tank, steel tank, 9,000 gallons on timber support, with piping.
- e) 1-Septic Tank, 3-Campos, 1-Distribution Box, 1-Off Interceptor, with sanitary connections.

III. Antennas:

- 1. AN-59 dipole, 11 each.

Provide twelve 20m. pre-stressed concrete poles. Remove and re-install six antenna and antenna coupling units, timber bases and ground rods. Antennas are presently installed at existing Communication Facility at Takhli Air Base. Remaining five antennas and all cable are new, GFM. Provide matching base supports and grounds.

- 2. ATS-50 vertical whip, 1 each.

Remove and re-install one ATS-50 antenna, tower, and ground screen. Provide concrete mounting pad, approximately 0.8m. x 0.8m. x 0.15m. to match existing. Antenna is presently installed at existing Communication Facility at Takhli Air Base.

- 3. 227B-3, Rotatable Leg Parabolic, 4 each.

For each antenna, provide one pile-supported concrete footing approximately 0.92m³, three concrete anchors of 1.8 m³ ea. and four concrete anchors of 1.8m³ ea., and erect government-furnished antenna consisting of one demountable tower with guys and rotating mechanism supporting a beam and radiator array, and grounds.

- 4. 753C-7/28, Conical Monopole, 7-28mc. 1 each.

Provide pile-supported concrete footing of approximately 0.92m³, four concrete anchors and rods, 0.86m³ ea., 4-ft. wooden fence and gate 20 m., and erect government-furnished antenna consisting of ground screen, 23-ft. guyed steel tower, radiator assembly, and grounds.

- 5. 753C-28, Conical Monopole, 2.5-10 mc., 1 each.

Provide pile-supported concrete footing of approximately 0.92 m³, four concrete anchors with rods, 0.86m³ ea., 4 ft. wooden fence and gate, 40 m., and erect government-furnished antenna consisting of ground screen, 66-ft. guyed steel tower and radiator assembly.

6. 747CA-3, Dismountable vertical log-periodic, 1 each.
Provide concrete pad of approximately 1.95m^3 , seven concrete anchors approximately 1.57m^3 ea., one $5\text{m} \times 0.20$ dia. treated wood pole for transformer mount, and erect government-furnished antenna consisting of 75 ft. guyed steel tower, radiating array, transformer, and grounds.
7. 747L-10, Horizontal log-periodic, 1 each.
Provide two pile-supported concrete tower footings each approximately 1.95m^3 six concrete anchors of 0.86m^3 ea., eight anchors of 0.86m^3 ea., and two anchors of 0.86m^3 ea., one $5\text{m} \times 0.20$ dia. treated wood pole, 4-ft. wood fence and gate and erect government-furnished antenna consisting of two 128-ft. guyed steel towers, radiating array, transformer, and grounding system.
8. 747V-29, Vertical log-periodic, 4-32mc., 1 each.
Provide one pile-supported concrete tower footing approximately 0.92m^3 , three concrete anchors of 2.56m^3 , three anchors of 1.54m^3 approximately 20 pipe-support piles, one $5\text{m} \times 0.20$ dia. transformer pole, 4-ft. wooden fence and gate 170 m., and erect government-furnished antenna consisting of 170-ft. guyed steel tower, horizontal pipe lengeron, radiating array, transformer, obstruction lights, and grounds.
9. Nested Rhombic Antenna, 7-28 mc. 1 each.
Provide eight pile-supported concrete tower footings each approximately 0.92m^3 , and 24 concrete anchors, and erect government-furnished antenna consisting of eight steel towers 80 to 120 ft., antenna array transformers and grounds.
10. UHF poles, 2 each.
Provide two 20m. pre-stressed concrete poles, with steps. One located adjacent to Transmitter Building, second located as directed in existing communications area at Tahkli Air Base.
11. Antenna connections:
Install government-furnished direct-burial coaxial antenna feed cable from transmitter building to each antenna.
Install government-furnished control cable from Transmitter building to 2738's, AN-59's and AT5-50.
Furnished and install direct-burial power feed cable from Transmitter building to 2738's and 747V-29.

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GC.21 Location: The work shall be located at [REDACTED] The exact location will be given by the Contracting Officer.

GC.22 Security Requirements: In general, no security requirements are necessary as the site is located outside a military base. Passes may be issued for base entry to the Contractor and/or his representatives on sufficient reason that such entry is necessary in connection with the completion of this contract.

GC.23 Materials and Workmanship: Unless otherwise specifically provided for in the specifications, all equipment, materials, and articles incorporated in the work covered by this contract are to be new and of the most suitable grade of their respective kinds for the purpose and all workmanship shall be first class. Where equipment, materials, or articles are referred to in the specifications as "equal to" any particular standard, the Contracting Officer shall decide the question of equality. The Contractor shall furnish to the Contracting Officer for his approval the name of the manufacturer of the machinery, mechanical and other equipment which he contemplates incorporating in the work, together with their performance capacities and other pertinent information. When required by the specifications, or when called for by the Contracting Officer, the Contractor shall furnish the Contracting Officer for approval full information concerning the materials or articles which he contemplates incorporating in the work. Samples of materials shall be submitted shall be submitted for approval when so directed. Machinery, equipment, materials, and articles installed or used without such approval shall be at the risk of subsequent rejection. The Contracting Officer may in writing require the Contractor to remove from the work such employee as the Contracting Officer deems incompetent, careless, insubordinate, or otherwise objectionable, or whose continued employment on the work is deemed by the Contracting Officer to be contrary to the public interest.

GC.24 Guarantee: All workmanship, equipment, and materials furnished by the Contractor under these specifications shall be guaranteed for a minimum period of one (1) year from the date of final acceptance thereof against all defects that might render the work unsatisfactory for the intended purpose. Defective materials and workmanship will be replaced by the Contractor without additional cost to the Government. The guarantee shall be in writing on the Contractor's own letterhead in the form specified by the Contracting Officer.

GC.25 Government-Furnished Material: The following listed materials will be furnished by the Government. All other materials and labor necessary for the completion of the work shall be furnished by the Contractor. All Government furnished materials and equipment shall be delivered to the site. The Contractor shall accept delivery at the tailgate of the transporting vehicle and be responsible for this material and/or equipment until final acceptance of the project.

<u>Item</u>	<u>Quantity</u>	<u>Unit</u>	<u>Description</u>
1	2	each	Diesel Electric Generator, 250 kw. rating, radiator cooled, air motor start, complete with exhaust flexible connections, exhaust silencer, air intake filter with silencer, 90° long radius exhaust elbow with exhaust piping insulation. Unit shall be complete in all respects ready for connecting fuel and air supply lines in the field. One complete spare set of filter elements shall be furnished, packed with the unit
2	2	each	Diesel Electric Generator, same as Item 1, except 150 kw.
3	1	each	Dual driven air compressor
4	2	each	Air receiver complete with safety valves, pressure gage and drain valve
5	2	each	Motor driven diesel fuel transfer pump
6	1	each	Wall mounted rotary type hand pump
7			Flexible pipe connections for the following:
	1	each	For exhaust pipe of engine-driven compressor
	3	each	For fuel supply line
	3	each	For fuel return line
	3	each	For air supply line
	1	each	For air line connecting air receivers and air compressor
	1	each	
8	1	each	Switch board, 240V, 3-phase, 3-wire
9	1	Lot	Antennas, accessories and connecting cables.

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GC.26 Customs Duties and Purchase Taxes: The Contractor shall pay all import duties and taxes resulting from the purchase of goods and/or service, except Government furnished items imported into the [REDACTED] for use in the construction or execution of this contract.

GC.27 Restriction of Source of Materials, Supplies or Manufactured Products: No materials, supplies or manufactured products originating from sources within Soviet-controlled countries or areas shall be used, furnished or installed under this contract. The prohibited area presently includes - Albania, Bulgaria, China, including Manchuria (excluding Taiwan, Formosa, but including Inner Mongolia, the Provinces of Tsinghai and Sikang, Sinkiang, Tibet and the former Kwantung Leased Territory, the present Port Arthur Naval Base Area and Lianing Province). Communist controlled area of Vietnam, Cuba, Czechoslovakia, East Germany (Soviet Zone of Germany and the Soviet Sector of Berlin), Estonia Hungary, Latvia, Lithuania, North Korea, Outer Mongolia, Poland and Danzig, Rumania and the Union of Soviet Socialist Republics.

GC.28 Blueprints Furnished Contractor: The Contractor will be furnished 10 sets of blueprints upon the execution of the contract. Additional prints in excess of this quantity will be provided by the Contracting Officer at nominal cost per print. One complete set of plans and specifications shall at all times be available at the site.

GC.29 Work Outside Regular Hours: If the contractor desires to carry on work outside of the regular hours, he may submit application to the Contracting Officer but shall allow ample time to enable satisfactory arrangements to be made by the Contracting Officer for inspecting the work in progress.

GC.30 Shop Drawings: The Contractor shall submit shop drawings as required by the specifications or otherwise requested by the Contracting Officer. These shop drawings and all supporting data, catalogs, brochures, etc., shall be prepared by the Contractor or his suppliers, but shall be submitted as the instruments of the Contractor. The Contractor shall ascertain that the drawings meet all requirements of the contract drawings and also conform to the structural and space conditions. All shop drawings shall be subject to the approval of the Contracting Officer.

GC.31 Specifications and Standards: Other specifications and standards are referred to in this specification, and shall govern in all cases where such references occur. In case of difference between such other specifications or standards and this specification, or its accompanying drawings, this specification or its accompanying drawings and standards shall apply. The requirements for packaging and preparation for shipment or delivery which may be included in the referenced specifications shall apply only to materials and equipment which are to be furnished and installed by the Contractor.

GC. 32 Optional Requirements: Where a choice of materials and/or methods is permitted herein, the Contractor will be given the right to exercise the option unless stated specifically otherwise.

GC.33 Definitions: Where "as shown", "as indicated", "as described", or words of similar import are used, it shall be understood that reference to the drawings accompanying this specification is made unless stated otherwise. Where "as directed", "as required", "as permitted", "approved", or words of similar import are used, it shall be understood that the direction, requirements, permission, approval, or acceptance of the Contracting Officer is intended unless otherwise stated. As used herein, "provided", "provision of", and "providing of" shall be understood to mean "provided complete in place", that is furnished and installed. For the purpose of these specifications, the word "shall" indicates mandatory requirements; the word "should" indicates recommended practices.

GC.34 Temporary Light, Water, Power, and Sanitary Facilities: The Contractor shall provide at his own expense light, power and water facilities for his use for construction. Water supply connections and pipings shall be installed only at such locations and in such manner as may be approved by the Contracting Officer. All temporary connections for electricity shall be subject to the approval of the Contracting Officer. Sanitary facilities for the use of the Contractor shall be installed only at locations approved by the Contracting Officer. Before final acceptance, temporary connections and piping and electric lines installed by the Contractor shall be removed in a manner satisfactory to the Contracting Officer. Temporary latrines shall be filled with materials obtained from borrow pits and compacted thoroughly in a manner satisfactory to the Contracting Officer.

GC.35 Form of Contract: The Contract will be executed on the Agreement Form provided, copy of said form is attached to this specification for information purposes only.

GC.36 Performance Bond: Performance and payment bonds will not be required.

GC.37 Insurance Required: The Contractor shall procure and shall maintain during the entire period of performance under this contract the following minimum insurance. Comprehensive General Liability and Automobile Liability, in each instance for bodily injury and property damage in amounts of not less than \$50,000 per person and \$100,000 per accident for bodily injury, and not less than \$200,000 for property damage. Prior to the commencement of work hereunder evidence of insurance shall be furnished in a form satisfactory to the Contracting Officer. In addition, the Contractor shall furnish evidence of a commitment by the insurance company to notify the Contracting Officer in writing of any material change, expiration or cancellation of any of the insurance policies required hereunder not less than 30 days before such change, expiration or cancellation is effective.

GC.38 Safety Requirements: The Contractor shall provide safety controls for protection to the life and health of employees and other persons; for prevention of damage to property, materials, supplies, and equipment; and for avoidance of work interruptions in the performance of this contract. Prior to commencement of work, the Contractor shall meet in conference with the Contracting Officer to discuss and develop mutual understanding relative to administration of the safety program.

GC.39 Progress Charts: The Contractor shall within five (5) days or within such time as determined by the Contracting Officer, after date of commencement of work, prepare and submit to the Contracting Officer for approval a practicable schedule, showing the order in which the Contractor proposes to carry on the work, the date on which he will start the several salient features (including the procurement of materials and equipment) and the scheduled dates for completing the same. The schedule shall be in the form of a progress chart of suitable scale to indicate approximately the percentage of work scheduled for completion at any time. The Contractor shall enter on the chart the actual progress at the end of each week or at such intervals as directed by the Contracting Officer and shall deliver to the Contracting Officer three copies thereof.

GC.40 Time for Completion: The Contractor shall commence construction upon written notice to proceed, and shall complete all work within 180 calendar days from the date of the notice to proceed except that occupancy and full use of the transmitter room in the transmitter building shall be afforded the Government within 140 calendar days from date of notice to proceed.

GC.41 Cost Breakdown: The Contractor shall within five days after execution of the Contract submit in a form acceptable to the Contracting Officer a schedule showing the subdivision of his contract consideration into its various component parts, this schedule will be the basis of computing progress payments. No payments will be made to the Contractor until such schedule has been submitted and approved by the Contracting Officer.

GC.42 Damages for Delay: The Contractor agrees to pay liquidated damages at the rate of 500 [REDACTED] per calendar day for each day after the specified completion dates until the work is completed.

GC.43 Form of Payment: Payment made to the Contractor shall either be in U.S. dollar or the local currency and shall be decided at the time of execution of the contract.

GC.44 Partial Payments: The Contractor shall submit by 20% incremental stages requests for partial payment based on the cost breakdown previously submitted complete with waivers for labor & material. Said requests will be certified by the Contracting Officer to the Government and payment made to the Contractor of the amount so certified within fifteen days. Said partial payment shall be for the amount certified less 10% retained. Payment of the retained percentage will be made 30 days after final acceptance of the work and receipt of full waivers of lien and affidavit.

GC.45 Drawings Accompanying Specifications: The drawings accompanying this specification are as shown as Attachment No. 1 to this specification and by reference hereto are incorporated into this specification.

GC.46 Final Cleanup: The Contractor shall, as directed by the Contracting Officer, remove from the buildings and site, at his own expense, all rubbish and waste materials resulting from his operations and leave the premises in a clean and orderly condition.

GC.47 Controlling Language: All matters in connection with the execution of this contract shall be in the English language. These matters shall include, but not be limited to, correspondence, drawings, specifications, technical data and conferences. Wherever any of these items are bilingual the English language shall be controlling.

- End of Section -

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SECTION 1 - SITE PREPARATION

1.1 General Requirements: The work includes the clearing and grubbing within the construction limits shown, and the disposal of waste material resulting therefrom.

1.2 Clearing: Brush and other vegetation shall be cut off flush with, the original ground surface.

1.3 Grubbing: Tree stumps shall be removed entirely. Tree roots and matted roots of brush shall be grubbed out to a depth of not less than 60 cm. below the finished subgrade for roads and buildings and to a depth of not less than 30 cm. for other locations.

1.4 Waste and Debris shall not be disposed of by piling it up along the limits of the area required to be cleared.

1.4.1 Non-Combustible waste and debris shall be gathered and disposed of as directed.

1.4.2 Combustible waste and debris shall be gathered for burning, except that when permitted (in writing) by the Contracting Officer, logs, and larger stumps may be removed and disposed of without burning at locations out of sight of public view.

1.4.2.1 Locations for Burning shall be either in the cleared area near the center or in adjacent open areas where existing trees or other vegetation will not be harmed.

1.4.2.2 Regulations of the local fire authority shall be complied with regarding burning methods. Fires shall be kept under constant attendance until the fires have burned out or have been extinguished.

1.4.2.3 Ashes shall be disposed of as for non-combustible material.

1.4.2.4 Private Property: Permission to dispose of waste and debris on private property shall be in writing. A copy of the permit shall be filed with Contracting Officer for approval.

1.4.2.5 Rehandling: When conditions are not suitable for burning operations and waste material interferes with subsequent construction, such material shall be moved to locations clear of construction operations and later rehandled and burned or disposed of at approved locations at all times.

- End of Section -

SECTION 2 - EARTHWORK

2.1 General Requirements: The work includes the providing of excavation, filling and backfilling, preparing embankment areas, formation of embankments, preparation of subgrades, construction of shoulders for roadways, complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

2.1.1 Weather Limitations: Earthwork operations shall be suspended at any time when satisfactory results cannot be obtained on account of rain or other unsatisfactory conditions of the field.

2.2 Applicable Specifications and Standards:

2.2.1 ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)

D698-64T Moisture-Density Relations of Soils, using 5.5 lb.
rammer and 12-in. drop (tentative).

2.3 Equipment: Any suitable and properly maintained type of equipment may be used. Equipment failing to achieve requirements specified shall be replaced.

2.4 Excavation:

2.4.1 Excavation for Structures shall conform to the dimensions and elevations shown, and the excavation shall extend a sufficient distance from the structure to allow for placing and removal of forms, and for inspection, except where concrete for structures is authorized to be deposited directly against excavated surfaces. When concrete is to rest on a surface other than rock, special care shall be taken not to disturb the bottom of the excavation, and excavation to the final grade level shall not be made until just before the concrete is to be placed.

2.4.2 Borrow Excavation shall consist of approved material excavated from borrow areas outside the normal grading limits for the completion of the embankments or for other purposes. Borrow excavation shall be made only at designated locations, and within the horizontal vertical limits as staked or directed.

The Contractor shall notify the Contracting Officer sufficiently in advance of the beginning of excavation in order that necessary tests can be made. Unsuitable material encountered in borrow operations shall be excluded from the work. All borrow pits shall be opened up to expose the vertical face of various strata of acceptable material to obtain a uniform product. Borrow pits shall be excavated to regular lines and shall be drained if practicable and left in a neat and presentable condition with all slopes dressed uniformly.

2.5 Over-Excavation: Excavations carried below the depths indicated, without specific directions, shall be refilled to the proper grade with suitable material and compacted thoroughly, except that in excavations for footings the concrete shall be extended to the bottom of the excavations; all additional work of this nature shall be at the contractor's expense.

2.6 Surface Drainage: Temporary drains and drainage ditches shall be installed as necessary to intercept or divert surface water that may affect the prosecution or condition of the work.

2.7 Filling and Backfilling:

2.7.1 Material shall consist of suitable excavated material or borrow of earth, sand, gravel, or other approved materials, and shall be free of roots, wood, scrap material, other vegetable matter and refuse. Moisture content shall be such that proper compaction will be obtained.

2.7.2 Backfill for Structures shall be placed, as far as practicable, as the work of construction progresses. Backfilling against concrete shall be done by when directed. Backfill shall be placed in horizontal layers not more than 15 cm. thick with each layer thoroughly and evenly compacted.

2.7.3 Fill for Structures and Roadways shall be placed in horizontal layers of not more than 15 cm. for the full width of the cross section, each layer to be thoroughly compacted and rolled before placing the next layer. Fill for structures shall be tested and proven to have attained a soil bearing capacity of not less than 2,000 PSF (10 tons/m²), or to a degree of compaction of not less than 95% of maximum density.

2.7.4 Degree of Compaction: Unless otherwise specified, the upper 15 cm. layer of fill within roadways and structures shall be compacted to a density of not less than 95% and 98% of maximum density respectively. All other fills shall be

compacted to a density of not less than 90% of maximum density. The maximum density as herein referenced shall be determined in accordance with the requirements of ASTM Designation D 698-58T, Method "D".

2.8 Preparation of Embankment Area:

2.8.1 Unsuitable Material within the top 15 cm. of the area on which embankment is to be placed shall be removed before the embankment is begun.

2.8.2 Depressions or Holes below the original ground surface shall be backfilled with suitable material, and shall be compacted flush with the adjacent ground surface.

2.9 Formation of Embankment:

2.9.1 Material shall consist of suitable excavated material or borrow of earth, sand, gravel or other approved materials, and shall be free from organic material and other objectionable matter. The maximum size particle for use in fill shall not exceed two-thirds the compacted layer thickness.

2.9.2 Grade Control: The lines and grade shall be established by the contractor and shall be maintained by means of grade stakes placed in lanes parallel to the center lines of the areas to be paved and spaced so that string lines may be stretched between stakes. All lines and grades will be checked by the Contracting Officer, but such check will not relieve the contractor of full responsibility for the correctness thereof.

2.9.3 Layers: Embankments shall be formed of suitable materials placed in successive horizontal layers of not more than 15 cms. in compacted depth for the full width of the cross section. Starting layers shall be placed in the deepest portion of the fill. Layers shall be constructed approximately parallel to the finished grade line.

2.9.4 Moisture Content: Wetting or drying of the material and manipulation to secure a uniform moisture content throughout the layer shall be accomplished as necessary. Should the material be too wet to permit proper compaction or rai-ling, all work on all portions of the embankment thus affected shall be delayed until the material has dried to the required moisture content.

2.9.5 Compaction: Each layer shall be compacted to not less than 90 percent maximum density at optimum moisture content, except that top 15 cm. shall be compacted to not less than 95 percent.

2.10 Preparation of Subgrades:

2.10.1 Unsuitable Material within the top 15 cm. of the subgrade area shall be removed.

2.10.3 Compaction: The subgrade shall be shaped to line, grade and cross-section, and the top 15 cm. of the subgrade shall be compacted to not less than 95 percent of maximum density obtained at optimum moisture content. Subgrade compaction shall be extended to include an area for a distance of at least 30 cm. beyond the edges of the widths designated for placement of base course material.

2.10.4 Moisture Content: Wetting or drying of the material and manipulation to secure a uniform moisture content shall be accomplished as necessary.

2.10.5 Tolerance: The finished compacted subgrade shall be blue topped by the Contractor at not less than 20 meter intervals along both shoulders. Any deviation from true grade in excess of 1.5 cm. shall be corrected by loosening, adding or removing materials, reshaping and recompacting.

2.11 Shoulder Construction for Roadways: Shoulders shall be constructed with suitable approved material. Shoulders shall be formed and compacted as soon as possible after the adjacent surfacing is complete. The entire shoulder area shall be uniformly and thoroughly compacted. The completed shoulders shall be true to alignment and grade, and shaped in conformity with the section shown, or as directed.

2.12 Acceptance of Subgrade or Embankment: Each lift of embankment material placed by the Contractor shall be subject to approval. No surface course material shall be placed on a prepared subgrade or on an embankment without the prior approval of the subgrade or embankment by the Contracting Officer.

2.13 Tests: All tests required by the Contractor to control the quality of the work, and as specified hereinafter, shall be made by the Contractor under the supervision of the Contracting Officer by and at the expense of the Contractor.

2.13.1 Moisture-Density Relationship of Soils: The Contractor shall conduct a minimum of one moisture-density relationship of each type of soil encountered in the work. A sample of each soil shall also be maintained in glass containers for subsequent reference purposes. Each container shall be labeled with the sample number, maximum dry density and the optimum moisture content. Test shall be in accordance with ASTM Designation D698-64T, Method D.

2.14 Direct Burial Cables shall be embedded in trenches and shall be covered with select natural backfill free from large sharp edged particles or any other material injurious to the cable. Excavation for direct burial cable may be done as necessary for installation of cable along the alignment and grades shown and with sides approximately vertical. Trench for cable shall have a minimum depth of 80 cm. and a minimum width of 40 cm. Trenches shall be in straight lines between cable connections, and bends in trenches shall have a radius of not less than 100 cm. Rock shall be removed to a depth of not less than 7.5 cm. below the cable or conduit depth and the space shall be filled with sand to provide a cushion. Such grading shall be done as may be necessary to prevent surface water from flowing into trenches. Cables at road crossings shall be entrenched and backfilled on all sides, top, and bottom with sand at least 10 cm. thick. Sand shall be clean, hard, mineral aggregate with 100 percent passing a No. 10 mesh sieve and not more than 5 percent passing a No. 100 sieve. Backfill shall be placed in horizontal layers compacted as specified. The layers up to an elevation 30 cm. above the top of the cable shall be not more than 15 cm. in loose thickness and the remainder of the layers above that elevation shall be not more than 15 cm. in compacted in thickness.

2.15 Ricefield checks outside embankment areas shall be graded and leveled to existing ground surface or to designated elevation in borrow areas to permit mechanical mowing.

2.16 Select Material Fill shall conform to paragraph 2.9.1 of this specification. If borrow fill from designated areas is not enough this select material fill shall be procured locally from approved sources with the approval of the Contracting Officer. The Contractor shall state the quantity and cost of this item in his bid summary.

- End of Section -

SECTION 3 - TOPSOILING, SPRIGGING AND SODDING

3.1 General Requirements: The work includes the providing of topsoil, sprigging and sodding for all area indicated on site plans.

3.2 Materials:

3.2.1 Topsoil shall be a natural friable clay or other soil having the characteristics of representative soils of the vicinity that produce grass or other vegetation. It shall be free from sub-soil, brush, objectionable weeds, stones, roots, and other objects larger than 5 cm. in diameter. Topsoil from earthwork operations may be utilized, or may be obtained from approved off-site locations that are naturally drained.

3.2.2 Sprigs shall be the healthy living stems and roots of local grasses capable of growing into a complete ground coverage mat. Unless otherwise shown, sprigs shall be obtained from heavy thickly matted sod in approved off-site locations having similar growing conditions. Sprigs shall be free of weeds or undesirable plants. When sprigs are cut, grass height shall not exceed 12 cm. Sprigs shall have soil adhering to the roots when planted.

3.2.3 Water shall be free from oil, acid, alkali, salt, and other substances harmful to plant growth. The source shall be subject to approval prior to use.

3.3 Inspection and Tests: Topsoil and sprigs will be inspected to determine their suitability for use in the work. No material shall be placed without prior approval.

3.4 Topsoiling: Where shown, topsoil shall be uniformly distributed to a thickness not less than 10 cm. thick. Excessively compacted areas shall be loosened to a depth of not less than 5 cm. Spreading shall be performed in such manner that planting can proceed without additional soil preparation. Topsoil shall not be placed when subgrade is excessively wet or extremely dry. Topsoil shall be fine graded to lines indicated, and free of depressions where water will stand. Surface undulations or irregularities shall be leveled before sprigging operation is begun.

3.5 Sprigging:

3.5.1 Harvesting of Sprigs: Method of harvesting shall be as approved. Sprigs may be collected or bunched for loading by rake or by hand. Sprigs shall be watered in small piles as soon as harvested, and shall be kept in shade and moist until planted.

3.5.2 Sprigging: Sprigs shall be planted within 24 hours after cutting. Sprigs shall be planted in shallow furrows not over 5 cm. deep. Furrows shall be made parallel with the contours of the slopes, not more than 20 cm. apart, and sprigs shall be planted in clusters (each having not less than 3 viable sprigs) not more than 10 cm. apart in the furrow. Cover the roots with soil immediately after placing in the furrow in such manner that the surface is left even at the designated grade.

3.5.3 Water shall be applied to the sprigged areas as closely after planting operations as reasonably possible, with approved equipment capable of wetting the soil to a depth of at least 5 cm.

3.6 Sodding: Sod shall contain a heavy thickly matted cover of living or growing grasses seasonably dormant during the dry season, and capable of renewing growth thereafter. Unless otherwise shown, sod shall be obtained from approved off-site locations having similar growing conditions.

3.6.1 Procuring Sod: After approval of the source, sod shall be cut into squares or rectangular sections, and shall be of size that will permit them to be lifted and rolled without breaking. Sod shall be placed roots to roots or grass to grass if stacked during transit and shall be kept moist. Care shall be exercised to retain the native soil on the roots of the sod during stripping, transporting and planting.

3.6.2 Solid Sodding: The sod shall be transplanted within 24 hours from the time it is stripped. Sod shall be laid smoothly, edge to edge, joints staggered and shall be pressed firmly into contact with the bed to eliminate all air packets and ensure knitting without displacement of the sod or deformation of the surfaces of sodded areas. Cracks between sods shall be filled with soil.

3.6.3 Finishing: After the sodding operation has been completed, the edges of the area shall be smooth. Excess material shall be spread uniformly over adjacent areas or disposed of as directed. When so indicated, sod shall be fastened in place with suitable wooden pins.

3.6.4 Watering: Sod shall be given one watering if it evidences excessive drying. The bed shall be soaked not less than 5 cm. deep.

3.6.5 Repair: If surface becomes gullied or otherwise damaged, affected portion shall be repaired as directed.

3.7 Contractor's Responsibility: The contractor shall protect the planted area during the time when vegetation is becoming established. If objectionable weeds or other undesirable growths threaten to smother the planted species, such vegetation shall be removed from the area.

- End of Section -

SECTION 4 - BASE COURSE

4.1 General Requirements: The work includes the providing of a crushed or uncrushed gravel or stone base course, complete, in strict accordance with the specification and the applicable drawings and subject to the terms and conditions of the contract.

4.2 Applicable Specifications and Standards:

4.2.1 ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)

C 117-62 T	Standard Method of Test for Amount of Material Finer than No. 200 Sieve in Aggregates.
C 131-55	Method of Test for Abrasion of Coarse Aggregate by use of the Los Angeles Machine.
C 136-63 T	Standard Method of Test for Sieve or Screen Analysis of Fine and Coarse Aggregates.
D 75-59	Methods of Sampling Stone, Slag, Gravel, Sand, and Stone Block for Use as Highway Materials.
D 423-61 T	Standard Methods of Test for Liquid Limit of Soils.
D 424-59	Standard Methods of Test for Plastic Limit and Plasticity Index of Soils.
D 698 -58 T	Methods of Test for Moisture-Density Relations of Soils, Using 5 ¹ / ₂ -lb. Rammer and 12 In. Drop.

4.3 Materials:

4.3.1 Crushed Rock and Crushed Gravel shall be free from vegetable matter, lumps of clay or other objectionable matter, and shall be durable and sound. That portion of the material retained on a No. 4 sieve shall be known as coarse aggregate, and that passing a No. 4 sieve shall be known as binder material.

4.3.1.1 Coarse Aggregate conforming to the requirements above, shall have a percentage of wear not to exceed 50 percent after 500 revolutions, as determined by ASTM designation C 131-55. Not less than 75 percent by weight of the coarse aggregate shall be composed of particles having at least one mechanical fractured surface.

4.3.1.2 Binder Material shall consist of sand, screenings, or other finely divided mineral matter, obtained from approved sources, or naturally combined with the coarse aggregate. It shall be free from vegetable or other objectionable material.

4.3.1.3 Gradation: The composite mixture of coarse aggregate and binder material shall conform to one of the following gradation, and shall not vary from the low limit on one sieve to the high limit on the adjacent sieve, or vice versa, but shall be well graded from coarse to fine. The material shall conform to the specified gradation both before and after placement and compact on. Sampling and testing shall be performed in accordance with the procedures promulgated in the applicable methods listed in Section 5.2, "Applicable Specifications and Standards".

<u>Sieve Size</u> (U. S. Standard Sieve Designation)	<u>Maximum Percent by Weight Passing</u>	
	<u>1 1/2" Max</u>	<u>3/4" Max.</u>
2"	100	100
1 1/2"	90 - 100	100
1"	-	100
3/4"	50 - 85	90 - 100
No. 4	25 - 45	35 - 55
No. 40	10 - 30	15 - 30
No. 200	2 - 10	5 - 15

4.3.1.4 Liquid Limit and Plasticity Index: That portion of the aggregate passing a No. 40 sieve in the gradation specified above shall have a liquid limit of not more than 25 and a plasticity index of not more than 6 when determined in accordance with ASTM designations D 423-61 T and 424-59, respectively.

4.4 Equipment: All plant, equipment, tools, and machines shall be suitable for the use intended, properly maintained and subject to approval.

4.5 Weather Limitations: Base courses shall not be constructed when weather conditions detrimentally affect the quality of the work in progress. Areas damaged by weather shall be aerated (if required), reshaped and recompacted.

4.6 Preparation of Sub-Grade: The previously constructed sub-grade shall be cleaned of all foreign substances and the surface approved for compaction and surface tolerances prior to constructing the base course.

4.7 Grade Control: The lines and grades shall be established by the Contractor and shall be maintained by means of grade stakes, placed in lanes parallel to the center lines of the areas to be paved when applicable, and spaced so that string lines may be stretched between stakes.

4.8 Placing Base Course Materials: The material shall be deposited, spread and compacted in layers, each not greater than 15 cm. thick. Areas of segregated material shall be removed and replaced with the specified material, or shall be remixed.

4.9 Compacting and Shaping: Each loose layer shall be rolled. Rolling shall progress from the sides to the center. Each successive track shall lap the preceding by at least 30 cm. Water shall be added, if necessary, in such manner and quantity that free water will not reach the underlying layer of sub-grade. Rolling shall continue until the material is thoroughly set and stable, and the layer is compacted through the full depth. Material shall not be rolled when the sub-grade is soft, yielding or when the rolling causes a wave-like motion in the layer. Rolling and blading shall be done alternately as necessary to obtain a smooth, even and uniformly compacted layer.

4.10 Hand Tamping: Areas inaccessible to rollers shall be compacted with hand tampers weighing not less than 22 kilograms and with a face area of not more than 650 square centimeters.

4.11 Smoothness: Areas having surface deviations in excess of 10 mm. when tested with a 2-meter straightedge applied parallel with and at right angles to the center line of the areas to be paved shall be corrected by loosening, adding and/or subtracting material, reshaping, watering (if necessary), and compacting the area involved, oil as specified herein.

4.12 Thickness: shall be measured at intervals in such manner that there will be a depth measurement for at least each 500 square meters of completed course. Measurements shall be made by test holes at least 7.5 centimeters in diameter through the course. Where the base course deficiency is more than 1.25 centimeters, the Contractor shall correct such areas by scarifying, adding material, reshaping, watering (if necessary), and compacting the area involved, all as specified herein. Where the measured thickness is more than 1.25 centimeters thicker than shown, it will be considered as the required thickness plus 1.25 centimeters for determining the average. The average thickness shall be the average of the depth measurement, and shall not vary from the thickness shown by more than 0.6 centimeter.

4.13 Density: Each complete lift of base course shall be compacted through its full depth to a density not less than 100 percent of the maximum density determined in accordance with the procedure promulgated in ASTM Test method D-698 -58T, Method D.

- End of Section -

SECTION 5 DOUBLE BITUMINOUS SURFACE TREATMENT

5.1 General Requirements: The work includes providing a bituminous prime coat on a previously constructed base course, on application of bitumen covered with mineral aggregate then compacted, followed by another application of bitumen covered with mineral aggregate, then compacted.

5.2 Applicable Specifications and Standards:

5.2.1 Federal Specifications:

SS-A-671b (GSA-F55)	Asphalt, (Petroleum Cut-Back for Road-work)
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SS-A-674c (GSA-F55)	Asphalt, Paving, Emulsion
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5.3 Materials:

5.3.1 Mineral Aggregate shall consist of crushed stone or crushed gravel, free from adherent film of clay, and shall be of such nature that a through coating of the bituminous material used in the work will not strip off upon contact with water. The moisture content of the aggregate shall not be sufficient to prevent it from being readily coated with the bituminous material.

5.3.1.1 Stripping Test: A test sample consisting of the aggregate and the bitumen to be used will be mixed at the temperature specified for the bitumen application. The sample will then be spread in a loose, thin layer and allowed to air-season for 24 hours before testing. A portion of the sample, not over 1/2 the capacity of the jar, will be placed in a glass jar and covered completely with distilled water. The jar will be fitted with a tight screw cap and allowed to stand for a period of 24 hours. The jar will be shaken vigorously for a period of 15 minutes, and the sample of the mixture will then be examined for stripping. If stripping occurs, the asphalt shall be treated in a manner such that the aggregate-asphalt mixture will meet the foregoing test.

5.3.1.2 Crushed Gravel: At least 70 percent of weight, of the particles retained on the No. 4 sieve shall consist of fractured angular pieces.

5.3.1.3 Size of Aggregates: The grading of the aggregates shall conform to the following:

<u>Percentage (By Weight)</u> <u>Passing Square Mesh Laboratory Sieves</u>		
<u>Sieve Designation</u>	<u>1st Application</u>	<u>2nd Application</u>
3/4 inch	100	
1/2 inch	90 - 100	
3/8 inch	40 - 55	100
No. 4	0 - 10	85 - 100
No. 8	0 - 5	10 - 40
No. 16	-	0 - 10
No. 50	-	0 - 5

5.3.2 Bituminous Material for Surface Treatment:

5.3.2.1 Rapid Curing Cut-Back Asphalt shall conform to Federal Specification SS-A-671b, grade RC-2, RC-4 or RC-5, as applicable. The temperature-viscosity relationship of the asphalt shall be furnished. Application temperature shall be as directed within the range of 140-210 degrees F for RC-2, 175 to 250 degrees F. for RC-4, and 200 to 275 degrees F. for RC-5. Application viscosity shall be between 25 and 100 seconds, Saybolt Furel.

5.3.2.2 Quick-Setting Emulsified Asphalt shall conform to Federal Specification SS-A-674c, type ES-1 having a viscosity in excess of 100 to 77 degrees F. Application temperature shall be as directed within the range of 75 - 130 degrees F.

5.3.3 Bituminous Material for Prime Coat shall be medium curing cut - back asphalt conforming to Federal Specification SS-A-671b, grade MC-0 or MC-1, as applicable. Application temperature shall be as directed within the range of 70 to 140 degrees F. for MC-0 and 110 to 185 degrees F. for MC-1.

5.4 Equipment: All plant equipment, tools, and machines shall be suitable for the use intended, properly maintained and subject to approval.

5.4.1 Bitumen Distributor: If used, the distributor shall have pneumatic tires of such width and number that the load produced on the base surface shall not exceed 650 pounds per inch of tire width. It shall distribute the bituminous material uniformly at even heat on variable widths of surface at readily determined and controlled rates from 0.2 to 6.0 liters per square meter, with a pressure range of 1.75 to 5.25 kg/cm and with an allowable variation from any specified rate not to exceed five percent.

5.4.2 Heating Equipment: The equipment for heating bituminous material may consist of steam coils and equipment for producing steam, designed so that steam will not be introduced into the material. If storage tanks are used, an armored thermostat with a range from 100 degrees F. to 300 degrees F., shall be fixed to the tank so that the temperature of the bituminous material may be determined at all times. The bituminous material may be heated by other means, as approved.

5.4.3 Mechanical Spreaders shall be adjustable and capable of spreading aggregate at controlled amounts per square meter. Aggregate may be spread by other means, as approved.

5.4.4 Power Rollers shall be self-propelled tandem or three wheel type rollers and shall be suitable for rolling bituminous pavements. The wheels of the rollers shall be equipped with adjustable scrapers. The rollers shall be equipped with water tanks and sprinkler apparatus, which will be used when necessary to keep the wheels wet, preventing the bituminous mixture from sticking to them.

5.4.5 Hand Tampers shall weigh not less than 11.3 kilograms and shall have a tamping face of not more than 323 square centimeters.

5.4.6 Broom Drags shall consist of brooms of the street type, mounted in a frame in such manner as to spread the aggregate uniformly over the surface of the area to be treated. The drags shall be equipped with tow plates for towing. Towing equipment shall be rubber-tired. Other means for spreading the aggregate may be used, as approved.

5.4.7 Power Blowers and Power Brooms shall be suitable for cleaning the surface to be paved. Other means may be used for cleaning the surface to be paved, as approved.

5.5 Preparation of Base Course: The previously constructed base course shall be cleaned of all foreign substances, and the surface prepared for compaction and surface tolerances prior to application of the double bituminous surface treatment.

5.6 Quantity of Material Applied shall be within the following limits:

<u>Application</u>	<u>Quantity Limits</u>
Bitumen, liters per square meter; prime coat	0.90 - 2.30
Bitumen, liters per square meter, 1st application	1.6 - 2.0
Aggregate, 1st spreading, kg per square meter	19.5 - 24.4
Bitumen, liters per square meter, 2nd application	0.9 - 1.1
Aggregate, 2nd spreading, kg per square meter	9.8 - 14.6

The rates of application of actual bitumen, as tabulated, are based on the bitumen content of the asphalt used. The kg of aggregate, indicated herein, are based on an apparent specific gravity of 2.65. For aggregate having an apparent specific gravity other than 2.65, adjustment in kg shall be made to insure constant volume per square meter.

5.7 Prime Coat shall be applied only when the base course is dry or contains moisture not in excess of that which will permit uniform distribution and the desired penetration. The bituminous material shall be applied uniformly, at even heat within a pressure range of 1.76 kg/cm² to 5.27 kg/cm² and with an allowable variation from the specified rate not exceeding 5 percent. Following the application of the bituminous material, the surface shall be allowed to dry for a period not less than 48 hours without being disturbed, or for such additional period of time as may be necessary to attain proper penetration and evaporation of the volatiles.

5.8 Surface Treatment:

5.8.1 First Application of Bitumen shall be uniform, and at a temperature and rate within the specified limits, as directed.

5.8.2 First Spreading, Brooming and Rolling of Aggregate: Immediately following the first application of bituminous material, aggregate shall be spread uniformly within the specified limits. Trucks spreading aggregate shall be operated backwards, so that the bituminous material will be covered ahead of the truck wheels. Back-spotting or sprinkling of additional aggregate over areas having insufficient cover shall be done whenever necessary. The surface shall be rolled immediately after sufficient aggregate is spread to prevent pick-up of the bituminous material. The surface shall be broom dragged immediately after the surface has set sufficiently to prevent excessive marking. Broom dragging, rolling, and backspotting shall be continued until no more aggregate can be worked into the surface, and the surface is cured and rolled sufficiently to key and set the aggregate. In all places not accessible to the rollers, the aggregate shall be adequately compacted with tampers. Any aggregate that become coated or mixed with dirt or any other foreign material shall be removed, replaced with clean aggregate, and rerolled, as directed. All surplus aggregates shall be swept off the surface and removed prior to the second application of bituminous material.

5.8.3 Second Application of Bitumen shall follow within 24 hours after the construction of the first course, weather permitting. If the treated surface is excessively moistened by rain within this period it shall be allowed to dry, as directed, before the second coat of bituminous material is applied. The second application of bituminous material shall be applied in the same manner as the first and at a rate within the limits specified.

5.8.4 Second Spreading, Brooming, and Rolling of Aggregate: Immediately following the second application of bitumen, aggregate conforming to the specified grading shall be spread uniformly over the bituminous material in amounts within the specified limits, and as directed. The aggregate shall then be rolled and broom-dragged until a smooth, even textured surface is produced.

5.8.5 Maintenance: The Contractor shall protect the treated areas from traffic for at least 24 hours after the second rolling and brooming.

- End of Section -

SECTION 6 - SUBBASE COURSE

6.1 General Requirements: The work includes the providing of a subbase course complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

6.2 Applicable Specifications and Standards:

6.2.1 ASTM: (American Society for Testing and Materials, 1916 Race Street, Philadelphia 3, Pa.)

C117-61T	Standard method of test for amount of material finer than No. 200 sieve in aggregates (tentative).
C136-61T	Standard method of test for sieve analysis of fine and coarse aggregates (tentative).
D75-59	Methods of sampling stone, slag, gravel, sand, and stone block for use as highway materials.
D423-51T	Standard methods of test for liquid limit of soils (tentative).
D424-59	Standard methods of test for plastic limit and plasticity index of soils.
D698-64T	Methods of test for moisture-density relations of soils, using 5 $\frac{1}{2}$ -lb. rammer and 12-in. drop (tentative).

6.3 Materials:

6.3.1 Aggregates shall be crushed stones, gravel, shell, sand, soil, or other sound, durable, approved materials processed and blended or naturally combined. Aggregates shall be free from lumps and balls of clay, vegetable matter, objectionable coatings, and other foreign materials. Material retained on the No. 4 sieve shall have a percentage of wear not to exceed 50 percent after 500 revolutions when tested by ASTM Standards C117 and C136 methods. Aggregates shall be sampled in accordance with ASTM D75-59.

<u>Sieve Designation</u>	<u>Percentage passing square-mesh Sieve No. 2</u>
No. 10	80
No. 200	15

6.3.2.1 Liquid Limit and Plasticity Index: That portion of the aggregate material passing a No. 40 sieve shall have a liquid limit of not more than 30 and a plasticity index of not more than 19 when tested in accordance with ASTM designation D423-61T and D424-59, respectively.

6.4 Equipment: All plant, equipment, tools and machines shall be suitable for the use intended, properly maintained and subject to approval.

6.5 Weather Limitations: Sub-base courses shall not be constructed when weather conditions detrimentally affect the quality of the work in progress. Areas damaged by weather shall be aerated (if required), reshaped and recompacted.

6.6 Preparation of Sub-Grade: The previously constructed sub-grade shall be cleaned of all foreign substances and the surface approved for compaction and surface tolerances prior to constructing the base course.

6.7 Grade Control: The lines and grade shall be established by the Contractor and shall be maintained by means of grade stakes, placed in lines parallel to the center lines of the areas to be paved when applicable, and spaced so that string lines may be stretched between stakes.

6.8 Placing Subbase Materials: The material shall be deposited, spread and compacted in layers each not greater than 15 cm. thick. Areas of segregated material shall be removed and replaced with the specified material, or shall be remixed.

6.9 Compacting and Shaping: Each loose layer shall be rolled. Rolling shall progress from the sides to the center. Each successive track shall lap the preceding by at least 30 cm. Water shall be added, if necessary, in such manner and quantity that free water will not reach the underlying layer or subgrade. Rolling shall continue until the material is thoroughly set and stable, and the layer is compacted through the full depth. Material shall not be rolled when the subgrade is soft, yielding or when the rolling causes a wave-like motion in the layer. Rolling and blading shall be done alternately as necessary to obtain a smooth, even and uniformly compacted layer.

6.10 Hand Tamping: Areas inaccessible to rollers shall be compacted with hand tampers weighing not less than 22 kilograms and with a face area of not more than 650 square centimeters.

6.11 Smoothness: Areas having surface deviations in excess of 10 mm. when tested with a 3-meter straightedge applied parallel with and at right angles to the center line of the areas to be paved, shall be corrected by loosening, adding and/or subtracting material, reshaping, watering (if necessary), and compacting the area involved, all as specified herein.

6.12 Thickness shall be measured at intervals in such manner that there will be a depth measurement for at least each 500 square meters of completed course. Measurements shall be made by test holes at least 7.5 centimeters in diameter through the course. Where the base course deficiency is more than 1.25 centimeters, the Contractor shall correct such areas by scarifying, adding material, reshaping, watering (if necessary), and compacting the area involved, all as specified herein. Where the measured thickness is more than 1.25 centimeters thicker than shown, it will be considered as the required thickness plus 1.25 centimeters for determining the average. The average thickness shall be the average of the depth measurement, and shall not vary from the thickness shown by more than 0.6 centimeter.

6.13 Density: Each complete lift of base course shall be compacted through its full depth to a density not less than 100 percent of the maximum density determined in accordance with the procedure promulgated in ASTM Test method D- 698-64T, Method D.

- End of Section -

SECTION 7 - STORM DRAINAGE SYSTEM

7.1 General Requirements: The work includes the providing of a storm drainage system, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

7.2 Materials:

7.2.1 Aggregate; Coarse, shall consist of gravel, or crushed gravel, or crushed stone, or a combination thereof, and shall be free from vegetable matter, alkali, clay lumps and other deleterious matter; the material shall be well graded from coarse to fine.

7.2.2 Cement shall be Portland cement dry and free from lumps and caking and, when packaged, shall be in bags or other strong and well-made packages which shall be plainly marked with the manufacturer's name and brand.

7.2.3 Reinforcing Steel shall be new billet stock, and shall have a minimum ultimate tensile strength of 3,700 kgs/sq.cm. and a minimum yield point of 2,320 kgs/sq.cm. Bars shall be free of scale, oil and structural defects, and shall be kept clean on the job.

7.2.4 Water for mixing and curing concrete shall be clean and free from amounts of oil, acid, alkali, salt and organic matter.

7.2.5 Concrete Pipe shall be of standard strength or of reinforced concrete. Except where otherwise shown, concrete shall have a minimum compressive strength of 3,000 psi. (210 kgs/sq.cm.) at 28 days using 6-inch diameter test specimens. Cement content shall not be less than 300 kgs. of cement per cubic meter. The type of joints shall be either the bell-and-spigot type or of the tongue and groove type. Pipes shall be free from defects, damaged ends and warp or misalignment.

7.2.6.1 Repairs: Pipe may be repaired, if necessary, because of occasional imperfections in manufacture or accidental injury during handling and will be acceptable if, in the opinion of the Contracting Officer, the repairs are sound and properly finished and cured, and the repaired pipe otherwise conforms to the requirements of this section.

7.3 Installation of Concrete Pipe:

7.3.1 Weather: Under no circumstances shall pipe be laid in water, and no pipe shall be laid when the trench conditions or the weather are unsuitable for such work, except with specific approval of the Contracting Officer.

7.3.2 Direction of Laying: Units shall be laid upgrade with the spigot ends of bell-and-spigot pipe and the tongue end of tongue-and-groove pipe pointing in the direction of flow; units shall be laid to the grades alignment shown.

7.3.3 Lowering: Proper facilities shall be provided for lowering units into trenches.

7.3.4 Bedding: The bedding surface shall provide a firm foundation of uniform density throughout the entire length. Soft, spongy, or otherwise unstable material encountered that will not provide a firm foundation for the pipe, shall be removed and replaced by suitable material to a depth of not less than 30 cm. Unless otherwise specified, all such unstable materials under the pipe shall be removed for the full width of the trench and replaced with suitable selected material. The exterior of the pipe or not less than 1/4 of its circumference shall be bedded in an earth foundation of uniform density. Select material shall be used for pipe bedding.

7.3.5 Mortar: Mortar shall be a mixture of portland cement, sand, and water mixed in the proportion by volume of 1 part portland cement to two parts of clean sand. Water in the mix shall not exceed 6 gallons per sack of cement. Mortar shall be used within 30 minutes from the time the ingredients are mixed with water.

7.3.6 Backfilling shall be in accordance with the applicable requirements as specified under the section entitled EARTHWORK.

7.3.7 Maintenance: Lines shall be maintained free of objectionable material until final acceptance of the work.

7.4 Headwalls shall be constructed as shown. Except where otherwise shown, concrete shall have a compressive strength of not less than 2,500 psi (175 kg/sq.cm.) in 28 days, and shall conform to the applicable requirements of the section entitled CONCRETE FOR STRUCTURES.

7.5 Grouted Stone Work: Rocks or stones shall be bedded in the foundation in straight rows with each rock or stone perpendicular to the finished surface. Rocks or stones shall be set in close contact, their flat surfaces up and their longest dimension at right angles to the centerline of the gutter. They shall break joints satisfactorily, and there shall be no interstices exceeding 2.5cm in width. The rocks or stones shall be rammed thoroughly until the surface is firm and conforms to the finished surface in grade, alignment and cross section. Any sections having an irregular or uneven surface shall be taken up and relaid satisfactorily. After the rocks or stones have been rammed into place and the surface is satisfactory, the spaces or voids between and around the rocks or stones shall be filled with cement grout. The cement grout shall be poured and broomed into the spaces between the rocks or stones, this operation being continued until the grout remains flush with the tops of the rocks or stones. The grout shall be of such consistency that it will flow readily into the spaces, but it must not be so wet that the solid matter separates from the water. Exposed surface shall be predominantly (75 percent or more) of rock or stone masonry. Surface joints shall be finished approximately flush with adjoining surfaces and troweled smooth.

- End of Section -

SECTION 8 - CONCRETE WORK

8.1 General Requirements: The work covered by this section includes the providing of concrete work for stiffeners, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

8.2 Materials:

8.2.1 Cement shall be portland cement, dry and free from lumps and caking and, when packaged, shall be in canvas bags or other strong and well-made packages each of which shall be plainly marked with the manufacturer's name and brand. A bag of portland cement shall contain 50 kg net. Cement salvaged by cleaning bags mechanically or otherwise, or from discarded bags of cement, shall not be used in the work. Corrective additions to remedy deficiencies in aggregate grading, cement replacements and admixtures desired for any other purposes may be used only with prior written approval.

8.2.2 Fine Aggregate:

8.2.2.1 Composition: Fine aggregate shall consist of either natural sand, manufactured sand, or a combination of natural and manufactured sand and shall be composed of clean, hard durable particles.

8.2.2.2 Particle Shape: Particles of the fine aggregate shall be generally spherical or cubical in shape.

8.2.2.3 Grading: Grading of the fine aggregate shall be as follows:

<u>Sieve Designation</u>		<u>Percentage by Weight</u>
<u>U.S. Std. square mesh</u>		<u>Passing</u>
3/8"	(9.50 mm)	100
No. 4	(4.75 mm)	95 - 100
No. 8	(2.38 mm)	80 - 100
No. 16	(1.19 mm)	50 - 85
No. 30	(0.59 mm)	25 - 60
No. 50	(0.30 mm)	10 - 30
No. 100	(0.15 mm)	2 - 10
No. 200	(0.07 mm)	0 - 4

8.2.2.4 Deleterious Materials In the fine aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Weight</u>
Clay lumps	1.0
Material finer than No. 200 sieve	3.0
Saturated surface-dry material, coarser than No. 50 sieve, floating on liquid having a specific gravity of 2.0	0.5

8.2.3 Coarse Aggregate:

8.2.3.1 Composition: Coarse aggregate shall consist of either gravel, crushed gravel, crushed stone, or a combination thereof, suitably processed and approved.

8.2.3.2 Quality: Aggregate, as delivered to the mixers, shall consist of clean, hard, angular, unweathered and uncoated particles. Where necessary, dust and other coatings shall be removed from the coarse aggregates by adequate washing.

8.2.3.3 Size and Grading: The maximum nominal size of the coarse aggregate shall be 38 mm. The coarse aggregate shall be well graded within the limits specified, and shall conform to the following grading requirements as delivered to the mixer:

<u>Sieve Size</u> <u>U.S. Standard square mesh</u>	<u>Percent by Weight Passing</u>
1 1/2" (38 mm)	90 - 100
1" (25 mm)	20 - 55
3/4" (19 mm)	0 - 15
3/8" (9.5 mm)	0 - 5
No. 200 (0.07 mm)	0 - 2

8.2.3.4 Deleterious Materials In the coarse aggregate shall not exceed the following limits:

<u>Material</u>	<u>Percentage by Weight</u>
Clay lumps	0.25
Material finer than No. 200 sieve	1.0
Saturated surface-dry material floating on liquid having a specific gravity of 2.0	1.0

8.2.4 Water for washing aggregate and for mixing and curing concrete shall be clean, fresh, and free from injurious amounts of oil, acid, salt, alkali, organic matter, or other deleterious substances.

8.2.5 Curing Materials may be waterproof paper, cotton mats, burlap, or other approved means.

8.2.6 Forms shall be of a good grade of lumber or plywood and shall be subject to approval.

8.2.7 Reinforcing Steel shall be plain, structural grade billet steel, free from rust and mill scale. Steel shall have a minimum tensile strength of 55,000 lbs. per sq. in. or 3,860 kg/sq. cm. and a minimum yield point of 33,000 lbs. per sq. in. or 2,320 kg/sq. cm. Deformed bars of equal strength may be substituted for plain bars without reduction in bar area.

8.2.8 Mesh Reinforcement, Wire shall be woven or electrically welded wire fabric, 6 inch by 6 inch mesh of 0.192 inch nominal diameter wire weighing approximately 42 lbs. per 100 square foot, conforming to ASTM Designation A185-61 T.

8.3 Forms and Falsework: Forms shall be constructed to conform to shape, form, and line required, and shall be maintained sufficiently rigid to prevent deflection of form material and consequent waviness in surface of concrete.

8.3.1 Design: Joints shall be sufficiently tight to prevent leakage of grout during placing and shall be arranged vertically or horizontally to conform to the pattern of the design. Lumber once used in forms shall have nails withdrawn and surfaces to be exposed to concrete carefully cleaned before reuse. Forms shall be readily removable without hammering or prying against the concrete.

8.3.2 Form Ties shall be of suitable design and adequate strength for the purpose. Wire ties will not be permitted.

8.3.3 Coating: Forms for exposed surfaces shall be coated with colorless mineral oil before reinforcement is placed. Surplus oil on form surfaces and any oil on reinforcing steel shall be removed.

8.3.4 Removal: Forms shall be removed only after approval and in a manner to insure complete safety of the structure.

8.4 Reinforcing Steel: Reinforcing steel fabricated to shapes and dimensions shown, shall be placed where indicated on drawings or where required to carry out the intent of the drawings and specifications. Before being placed, reinforcing steel shall be thoroughly cleaned of loose or flaky rust, mill scale, or coating, and of any other substance that would reduce or destroy the bond. Reinforcing steel reduced in section shall not be used. After any substantial delay in the work, previously placed reinforcing steel left for future bonding shall be inspected and cleaned. Reinforcing steel shall not be bent or straightened in a manner injurious to the steel. Bars with kinks or bends not shown on drawings shall not be placed. The use of heat to bend or straighten reinforcing steel will not be permitted.

8.5 Strength Requirements: Concrete required for the project shall be proportioned and mixed for a minimum ultimate compressive strength at 28 days of 3,000 lbs per sq.in. or 210 kg per sq.cm. using standard 6 inch diameter cylindrical specimens.

8.6 Proportioning of Concrete Mixes: Concrete shall be mixed by volume in the proportion of one part cement to 2.5 parts fine aggregate and 4 parts coarse aggregate.

8.6.1 Cement: A bag of portland cement will be considered as 50 kg in weight. The concrete as mixed shall contain not less than six 50 kg bags of cement per cubic meter.

8.6.2 Cement-Water Ratio: The concrete shall contain not more than 29 liters of water per 50 kg bag of cement in the mixed concrete, unless otherwise directed in order to obtain the specified slump.

8.6.3 Concrete Strength and Proportioning is based on the assumption that saturated-surface dry aggregates are used, and/or that the amount of water specified includes the free water in the aggregate.

8.7 Workability: The consistency of the mixture shall be that required for the specific conditions and methods of placement. The slump shall fall within the following limits:

<u>Slump for vibrated concrete</u>	
<u>Minimum</u>	<u>Maximum</u>
5.0 cm	10.0 cm

8.8 Batching and Mixing:

8.8.1 Concrete Mixing Equipment shall be power operated and in good mechanical condition. Hand mixing will not be permitted without written approval. Provisions shall be made for introducing cement, aggregate and water into the mixer in the proper quantities.

8.8.2 Mixers shall not be charged in excess of rated capacity nor be operated in excess of rated speed. Excessive mixing, requiring addition of water to preserve required consistency, shall not be permitted. The entire batch shall be discharged before recharging.

8.8.3 Mixing Time shall be measured from the instant water is introduced into the drum containing all solids. All mixing water shall be introduced before one-fourth of the mixing time has elapsed. Mixing time for mixers of $\frac{3}{4}$ cu.m. or less shall be 1 $\frac{1}{4}$ minutes; for mixers larger than $\frac{3}{4}$ cu.m. mixing time shall be increased 15 seconds for each additional $\frac{1}{2}$ cu.m. or fraction thereof.

8.9 Embedded Items: Before placing concrete, care shall be taken to determine that all embedded items are firmly and securely fastened in place as indicated on the drawings or as directed. All embedded items shall be thoroughly cleaned and free from oil and other foreign matter such as loose coatings of rust, paint and scale.

8.10 Preparation for Placing: Water shall be removed from excavation before concrete is deposited. Hardened concrete, debris and foreign materials shall be removed from interior of forms inner surfaces of mixer and conveying equipment. Reinforcement shall be secured in position, inspected and approved before pouring of concrete.

8.11 Placing Concrete: Concrete shall be handled from mixer to place of final deposit in a continuous manner, as rapidly as practicable, and without segregation or loss of ingredients until the approved unit of operation is completed. Concrete that has attained its initial set or has contained its mixing water for

more than 45 minutes shall not be placed in the work. Forms or reinforcement shall not be splashed with concrete in advance of pouring. Concrete shall be placed in the forms as nearly as practicable in final position. Immediately after placing, concrete shall be compacted by thoroughly agitating it in an approved manner. Tapping or other external vibration of forms will not be permitted. Concrete shall not be placed on concrete sufficiently hard to cause formation and planes of weakness within the section.

8.11.1 Concrete shall not be placed except in the presence of the Contracting Officer not prior to his approval of forms and placement of reinforcing bars. In no case shall approval relieve the contractor of responsibility for the work.

8.12 Compaction:

8.12.1 Concrete shall be compacted by hand spading and rodding or by mechanical vibrators. Compaction shall continue until all voids are filled but care shall be taken to prevent segregation of materials.

8.12.2 Vibrators shall in no case be used to transport concrete inside forms. Use of form vibrators will not be permitted. Internal vibrators shall maintain a speed of not less than 5,000 impulses per minute when submerged in the concrete.

8.13 Finishes of Concrete: Slight honey-comb and minor defects in all concrete surfaces shall be patched with cement mortar of one part cement and two parts sand. Trowel finish shall be obtained by tamping the concrete with special tools to force the coarse aggregate away from the surface, then screeding and floating with straight edges to bring the surface to the required finish level shown on the drawings. While the concrete is still green but sufficiently hardened to bear a man's weight without deep imprint, it shall be wood floated to a true even plane with no coarse aggregate visible. Sufficient pressure shall be used on the wood floats to bring moisture to the surface. The concrete shall then be hand-trowelled to produce a smooth impervious surface free from trowel marks. An additional trowelling shall be given the surface for the purpose of burnishing. The final trowelling shall produce a ringing sound from the trowel.

8.14 Curing: Curing shall be accomplished by preventing loss of moisture, rapid temperature change, and mechanical injury from rain or flowing water for a period of 7 days when normal portland cement has been used, or 3 days when high early strength portland cement has been used. Curing shall be started on

soon after placing and finishing as free water has disappeared from the surface of the concrete.

8.14.1 Moist Curing: Unformed surfaces shall be covered with burlap, cotton, or other approved fabric mats, or with sand and shall be kept continually wet. Forms shall be kept continually wet and if removed before the end of the curing period, curing shall be continued as on unformed surfaces, using suitable material.

- End of Section -

SECTION 9 - MASONRY

9.1 General Requirements: The work includes the providing of all brick masonry work, complete, in strict accordance with the applicable drawings and specifications and subject to the terms and conditions of the contract.

9.2 Brick: Common brick shall be of the type and sizes conforming to local brick standards.

9.3 Mortar shall be in the proportion of 1 part portland cement, 1 part hydrated lime and 4 1/2 parts sand mixed with sufficient water to make a mortar of such consistency that it can be handled easily with a trowel. Mixing shall be performed in mechanical mixers, unless hand-mixing and equipment used are approved by the Contracting Officer. The dry materials shall be thoroughly mixed before water is added. The mortar shall be used within 45 minutes after mixing or shall be discarded. Retempering of mortar will not be permitted.

9.4 Laying of Units: No brick having a film of water on its surface shall be laid. Bricks shall be wetted before laying. Each brick shall be laid in a full bed of mortar. Brick shall be laid plumb, true to line, with level courses, and with each course breaking joints with the course next below. Any brick that are disturbed after the mortar has stiffened shall be removed and relaid with fresh mortar. Mortar in the joints of the brickwork shall be struck off flush.

- End of Section -

SECTION 10- WATERPROOFING

10.1 General Requirements: The work includes the providing of waterproofing complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

10.2 Applicable Specifications and Standards:

10.2.1 Federal Specifications:

SS-A-666 (1)	Asphalt; (for) built-up roofing, waterproofing and dampproofing.
HH-F-185 (1)	Felt, asbestos, asphalt-saturated, uncoated, for flashings, roofing and waterproofing.

10.3 Materials:

10.3.1 Hot Asphalt shall conform to Federal Specification SS-A-666 (1).

10.3.2 Impregnated Fabric Flashing shall be 15 pound felt and shall conform to Federal Specification HH-F-185 (1).

10.4 Installation:

10.4.1 Impregnated Fabric Flashing shall be installed where shown. At wall mopped the polystyrene insulation with hot asphalt and set the fabric flashing as shown. In between the brick masonry joint cast one end of the fabric flashing mopped with hot asphalt, and cast in place with the cement mortar used for jointing the next brick layer, to give a watertight construction.

10.5 Emulsified Seal consisting of selected asphalt and aluminum flakes with vehicle admixture shall be applied on the roof slab to provide a watertight surface and to serve as a heat reflector.

- End of Section -

SECTION 11 - PLASTERING

11.1 General Requirements: The work includes the providing of all plaster work complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

11.2 Materials:

11.2.1 Cement: Portland cement, type for general concrete construction.

11.2.2 Sand: Salt free, clean and screened, gradation as follows:

<u>Sieve size</u>	<u>Percent by weight retained</u>	
	<u>Maximum</u>	<u>Minimum</u>
No. 4 (4.76 mm)	0	0
No. 8 (2.38 mm)	5	0
No. 16 (1.19 mm)	30	5
No. 30 (0.59 mm)	65	30
No. 50 (0.297 mm)	95	65
No. 100 (0.149 mm)	100	90

11.3 Protection: Woodwork, glass, floors and other finishes shall be carefully protected from damage and from plaster droppings. All damages shall be repaired and necessary patching shall be done by the Contractor.

11.4 Workmanship: Plastering shall be carefully installed. Finish surfaces shall be plumb, straight, true and free from waves or defects of any kind.

11.5 Proportions: Cement plaster for all coats shall be mixed in the proportions of 1-part portland cement, 3-parts sand, and 1/10-part hydrated lime.

11.6 Application of Plaster: Properly regulated ventilation shall be provided in areas being plastered. Masonry surfaces on which suction must be reduced shall be dampened with a fog spray. Unless otherwise indicated, plastering shall be 3-coat work on all plaster bases, and the scratch and brown coats shall be carried down to the floor. Finish coats shall have a reasonably uniform thickness of approximately 10 millimeters, and the minimum thickness at any point shall be 8 millimeters. The thickness of the plaster, from the face of the

plaster base to the finished plaster surface, shall be not less than 15 millimeters over masonry. Plaster corners above bull-nose facing-tile wainscots shall be neatly molded to the radius of the facing tile and formed flush therewith. Plaster shall be applied over rigid insulation where suspended ceiling is not specified.

11.6.1 Scratch Coat shall be full and thick and shall be applied with sufficient force to form good keys. The scratch coat shall be cross-scratched upon attaining its initial set and shall be kept damp with a fog spray.

11.6.2 Brown Coat shall be applied after the scratch coat has set, but not less than 24 hours after the application of the scratch coat, when applied directly to masonry, the brown coat shall be applied with sufficient pressure to fill the joints, to prevent air pockets and secure a good bond. The brown coat shall be lightly scratched and broomed, shall be kept moist with a fog spray for 2 days, and then be allowed to dry out.

11.6.3 Finish Coat shall not be applied until the brown coat has seasoned for 7 days. Just before application of the finish coat, the brown coat shall again be wetted evenly with a fog spray. Cement plaster shall be given a sand float finish of an approved uniform texture. The finish coat shall be kept moist with a fog spray for at least 2 days, and thereafter shall be protected against rapid drying until properly and thoroughly cured.

11.7 Patching: Plaster containing cracks, blisters, pits, checks, or discoloration will not be acceptable. Such plaster shall be removed and replaced with conforming to this specification. Patching of defective work will be permitted only when approved, and such patching shall match existing work in texture and color.

- End of Section -

SECTION 12 - CAULKING

12.1 General Requirements: The work involves the providing of all caulking work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

12.2 Materials:

12.2.1 Caulking Compound shall be composed of pigments (with or without fibers) uniformly mixed in a liquid vehicle to a plastic consistency for gun application, and shall be specially manufactured as being suitable for the use intended. The compound shall adhere tenaciously to the surface to which applied, shall not shrink excessively and shall be non-staining. Color shall be light gray.

12.2.2 Sealer shall be a mixture of aluminum paste, spar phenolic resin varnish and thinner that is compatible with the varnish, mixed in the proportion of 0.9 kg. of paste to not more than 3.78 liter of thinner. The materials shall be field mixed.

12.2.3 Rope Yarn shall be the revealed strands of rope fiber, free from oil or other staining elements.

12.3 Samples of all materials proposed for use shall be submitted to the Contracting Officer for approval.

12.4 Preparation of Surfaces:

12.4.1 Cutting of Grooves: Where grooves in concrete and masonry are indicated and not formed, the grooves shall be cut and cleaned out to a minimum depth of 19 mm. and ground to a minimum width of 6.35 mm. without damage to adjoining work.

12.4.2 Backstop: Joints and spaces to be caulked that are deeper than 15 mm. shall be firmly packed with rope yarn to within 15 mm. of the surface.

12.4.3 Cleaning: Joints and spaces to be caulked shall be raked and cleaned out to a depth of 15 mm., and all particles of mortar, dust, and other foreign matter shall be brushed out just prior to caulking.

12.4.4 Priming: Grooves in concrete, masonry, and wood that will absorb the essential oils from the caulking compound shall be primed using a brush that will reach all parts of the grooves to be filled with compound. The primer shall be allowed to dry thoroughly.

12.5 Caulking compound shall be forced into the joints with a pressure caulking gun using nozzles of the proper size to fit the width of the joints. Joints shall be completely filled. Surface shall be uniformly smooth and free from wrinkles, and shall be sufficiently convex to result in a flush joint when dry. Excess material shall be removed.

12.6 Re-caulking: Upon completion of the caulking, any joints not completely filled shall be roughened and filled as specified, and the exposed surface tooled smooth.

12.7 Cleaning: Adjacent materials which have been soiled due to the caulking operation shall be cleaned immediately and the work left in a neat, clean condition.

- End of Section -

SECTION 13 - TERRAZZO

13.1 General Requirements: The work includes the providing of all terrazzo work, complete, in strict accordance with the specification and applicable drawings, and subject to the terms and conditions of the contract.

13.2 Materials:

13.2.1 Portland Cement shall conform to the applicable requirements of the section entitled CONCRETE WORK.

13.2.2 Water shall conform to the applicable requirements of the section entitled CONCRETE WORK.

13.2.3 Sand shall be clean, siliceous masonry sand passing a 19 millimeters screen.

13.2.4 Coloring Material shall be the best quality of mineral pigment of high purity, shall be finely ground, sunproof, and limeproof, and shall have a specific gravity similar to that of portland cement. Coloring material shall not exceed 5 percent, by weight, of the cement used.

13.2.5 Marble Chips shall be hard and durable. Size No. 1 chips shall pass a 1/4-inch-mesh screen and be retained on a 1/8-inch-mesh screen. Size No. 2 chips shall pass a 3/8-inch mesh screen and be retained on a 1/4-inch-mesh screen.

13.2.6 Mortar shall be composed of one part cement and three parts of sand thoroughly mixed dry before adding sufficient water for proper workability.

13.2.7 Cleaning Compound used for cleaning terrazzo shall be an approved neutral chemical cleaner free from acids and strong alkalis or other material that would affect the color or otherwise damage the terrazzo.

13.2.8 Preservative Material for terrazzo floors shall be an approved material of a type required to produce a waterproof finish that will not be impaired by immersion in water at room temperature for a period of 24 hours, approximately 18 hours after the floor is finished by buffing, as specified. The preservative material shall not discolor the terrazzo nor leave a tacky or sticky finish film on the surface after buffing.

13.2.9 Terrazzo shall be composed of 1 part cement and 2 parts marble chips of the sizes and colors selected by the Contracting Officer from the samples submitted to him for approval.

13.2.10 Division Strips shall be 3 millimeters thick of brass and shall not be less than 19.6 millimeters wide. Strips shall be of the same material and thickness and shall conform to the profile of the base.

13.3 Preparation for Terrazzo: Concrete slabs shall be of a suitable rough texture to bond to the terrazzo finish. Any surface that is too smooth shall be roughened with a toothed chisel and, prior to laying the terrazzo, shall be cleaned of all dirt, oil, grease and extraneous material.

13.3.1 Division Strips for terrazzo floors shall be set immediately after spreading the underbed, the strips being partially embedded therein, securely anchored to the sub-floor and grouted solid. Division strips shall be set straight to lines and to the proper level to ensure that the tops of the strips will show uniformly after grinding and smoothing operations are completed. Joints and intersections shall be fitted tight. Strips shall be braced to prevent bulging during the placing of the terrazzo.

13.4 Sample Pattern: The contractor shall construct for approval two one meter square sample models, for the Contracting Officer's approval, of each color pattern of the terrazzo work proposed for the project. One sample will be retained by the Contracting Officer and the other returned to the contractor.

13.5 Laying Terrazzo: The forms shall be swept clean and moistened, installed in the green underbed. The terrazzo mix shall be spread, tamped, and rolled into a compact mass of sufficient depth that after surface grinding the thickness shall be as shown. After rolling, additional aggregate mix shall be sprinkled over the surface to fill up all depressions, to take up excess moisture, and to permit the terrazzo to be troweled to a level, dense, and even surface, slightly above the finish line of the floor. This level shall allow for the surface grinding necessary to expose the specified area of aggregate, and to produce smooth, level surface free of waves and depressions.

13.6 Curing: The completed terrazzo shall be kept moist and free of traffic during a 6-day curing period. The curing shall be accomplished by (1) covering with approximately 25 millimeters thickness of sand, or (2) covering with building paper or mats, or (3) sprinkling with water at not over 10-hour intervals.

13.7 Surfacing: Following the curing period, the terrazzo shall be machine-ground to a true even surface using No. 24 grit followed by No. 80 grit or finer abrasive stone. After the first grinding, the surface shall be thoroughly grouted with the same cement and color composition as specified for the matrix of the terrazzo mix. The grout shall be of the consistency of thick cream, and shall be brushed over the surface to eliminate all imprisoned air and to thoroughly fill the surface for final grinding.

13.8 Finishing: Not less than 72 hours after application, the grouting coat shall be removed by grinding. In the latter stages of grinding the grit stones or other abrasive used in the grinding machine shall be of a grain that will give the surface a honed finish. Small areas, inaccessible portions, and corners that cannot be reached by the grinding machine shall be ground and rubbed by hand. The honed surface of finished terrazzo shall show not less than 70 percent of the area as exposed aggregate evenly distributed, and shall conform in appearance to the approved samples.

13.9 Protection: After the finish grinding has been completed and the surface treatment applied, the terrazzo work shall be covered and protected with approved material until completion of the work of all other trades.

13.10 Cleaning and Coating: Prior to the placing of the protective covering, or if approved, after the work of all other trades has been completed and the protective covering removed, terrazzo work shall be washed with an approved cleaning compound mixed with warm water, and shall be cleaned with a fine abrasive where necessary to remove any stains or cement smears. The terrazzo shall be allowed to dry thoroughly and shall be given a sealing application of approved preservative material. The sealing preparation shall be applied in accordance with the manufacturer's directions, leaving all terrazzo work in clean condition as approved.

- End of Section -

SECTION 14 - VINYL-ASBESTOS FLOOR TILE

14.1 General Requirements: The work includes the providing of vinyl-asbestos tile flooring complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

14.2 Applicable Specifications and Standards:

14.2.1 Federal Specifications:

L-T-00345 (COM-NBS)	Tile, Floor, Vinyl-Asbestos
SS-A-701	Asphalt-Primer; (for) Roofing and Waterproofing.
ZZ-T-301a	Tile; Floor, Rubber

14.3 Samples: Duplicate sets of the manufacturer's standard color chips, not less than 3 by 3 inches showing typical color, finish, and surface pattern of each type of floor covering, shall be submitted to the Contracting Officer for color selection prior to the submission of samples. The samples of floor covering materials in the colors selected shall be submitted to the Contracting Officer for approval before the work is started.

14.4 Materials:

14.4.1 Vinyl-Asbestos Tile, 1/8-inch thick, 9 by 9 inches conforming to Federal Specification L-T-00345 (COM-NBS).

14.4.2 Rubber Cove Base, top set type, 4-inches high, 1/8-inch thick, in color, conforming to the applicable portions of Federal Specification ZZ-T-301a, shall be provided where indicated. Base shall be the standard product of the manufacturer of the floor covering, and shall be sufficiently flexible to conform to irregularities in wall, partitions, and floors.

14.4.3 Adhesive shall be a water-resistant cement specifically recommended by the manufacturer of the vinyl-asbestos tile flooring.

14.4.4 Metal Edging Strips shall be of aluminum or other light-colored non-ferrous metal, as approved.

14.4.5 Primer, Cut-Back Type shall conform to Federal Specification SS-A-701.

14.5 Preparation of Concrete Subfloor: The concrete surfaces to receive the tile shall be swept clean, and shall be free from moisture, paint, wax, and other materials that could affect the action of the adhesive or the smoothness of the applied flooring. Cracks and uneven areas shall be patched or repaired with an approved plastic material.

14.6 Installation:

14.6.1 Vinyl-Asbestos Tile: Concrete subfloors shall be primed with a cut-back type primer worked into the surface of the concrete, using the minimum quantity that will cover the surface completely with a non-absorptive base. If the primer, after having dried or "set" can be peeled easily from the concrete subfloor, the work shall stop until the primer adheres tightly to the subfloor. Adhesive shall be applied over the primed surface in accordance with the adhesive manufacturer's printed directions. Vinyl-asbestos floor tile shall be applied in a checker board pattern, starting in the center of the room, and working from the center toward the edges or borders. Tile shall be carefully laid in the pattern, and fitted so that each tile is in contact with the adjoining tiles, and all joints are tight and in alignment. Metal edging shall be provided where floor covering terminates at point higher than the contiguous finished flooring, except at doorways where thresholds are provided. The strips shall be anchored to concrete floor with counter-sunk screws into metal or fiber expansion sleeves.

14.6.2 Rubber Cove Base: Rubber cove base shall be applied after flooring has been completed, and the wall surface, to which the base is to be applied, is thoroughly dry. All cracks and voids in the wall shall be filled with an approved crack filler. Special base adhesive as recommended by the floor covering manufacturer, shall be applied to the back of the base with a notch trowel, leaving approximately 1/4-inch bare space along the top edge of base. The base shall immediately be pressed firmly against the wall and moved gently into place, making sure that the toe is in contact with the floor and wall. The entire surface of the base shall be rolled with a handroller, and then the toe of the base shall be pressed firmly against the wall with a straight piece of wood. Corners shall be formed with factory preformed corners.

14.7 Cleaning: Immediately upon completion of the installation in a room or an area, floors and adjacent surfaces shall be dry cleaned with an approved cleaner to remove surplus adhesive. Floors shall not be washed for at least 5 days after installation; then washed with an approved non-alkaline cleaning solution and rinsed thoroughly with clear cold water.

14.8 Protection: From the time of cleaning until acceptance, the flooring shall be properly protected where subsequent building operations might damage the floor.

- End of Section -

SECTION 15 - TILE WORK

15.1 General Description: The work includes providing all tile work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

15.2 Materials:

15.2.1 Glazed Ceramic Tiles shall be $4\frac{1}{4} \times 4\frac{1}{4} \times \frac{3}{8}$ inch thick and shall have matte glazed finish on exposed-to-view surfaces. Stops, returns, trim units, caps and special shapes shall be provided as required for sills, jambs, recesses, offsets and other conditions so as to provide a complete and neatly finished installation. Color shall be as approved by the Contracting Officer.

15.2.2 Lime: Lime shall be hydrated lime suitable for tile work. The total unhydrated calcium oxide (CaO) and magnesium oxide (MgO) in the hydrated product shall not exceed 8 percent by weight, calculated.

15.2.3 Sand for setting beds, base coats and grout shall be clean, washed, sharp, durable particles, free from silt, loam, clay, soluble salts, and organic impurities. Sands for setting bed of floors shall be well graded, passing a No. 8 sieve, with not more than 8 percent passing a 100-mesh screen. Sand for grout shall be screened to pass a 30-mesh sieve, with not more than 5 percent passing a 100 mesh screen.

15.2.4 Cement shall conform to the applicable requirements of the section entitled Concrete Work, except cement for wainscoat shall be white cement.

15.2.5 Water shall be clean and free from injurious amounts of oils, acids, soluble salts, and organic impurities.

15.3 Samples: Samples of materials shall be submitted to the Contracting Officer for approval before proceeding with the tile work.

15.4 Installation of Wainscoat:

15.4.1 Scratch Coat: Scratch coat for application as a foundation coat shall be not less than $\frac{1}{4}$ -inch (6 mm.) thick composed of one part cement, 4 parts

sand, and 1/4 part hydrated lime by volume. While still plastic, the scratch coat shall be deeply scored or scratched and cross-scratched. The scratch coat shall be protected and kept reasonably moist during the seasoning period. All mortar for scratch and float coats shall be used within one hour after mixing. The retempering of partially hardened mortar will not be permitted. The scratch coat shall be applied not less than 48 hours nor more than 54 hours before starting the setting of tile.

15.4.2 Float Coat: The float coat shall be composed of 1 part cement, 1/2 part of hydrated lime and 4 parts sand. The float coat shall be brought flush with screeds or temporary guide strips so placed as to give a true and even surface at the proper distance from the finished face of the tile.

15.4.3 Setting Wainscoat: Wainscoat shall be thoroughly soaked in clean water before setting. Wainscoat shall be set by trowelling a skim coat of neat Portland cement mortar on the float coat or applying a skim coat to the back of each tile unit and immediately floating the tile into place. Joints shall be straight, level, perpendicular, and of even width not exceeding 1/16-inch (2 mm.). Wainscoats shall be built of full courses, which may extend to a greater height, but in no case more than 1-1/2-inches (4 cm) lower than the specified or figured height. Vertical joints shall be maintained plumb for the entire height of the tile work.

15.4.4 Grouting: All joints in wainscoat shall be grouted full with plastic mix of neat white cement immediately after a suitable area of tile has been set. The joints shall be tooled slightly concave and the excess mortar shall be cut off and wiped from the face of tile. Any interstices or depressions in the mortar joints after the grout has been cleaned from the surface shall be roughened at once and filled to the line of the cushion-edge before the mortar begins to harden. All joints between wainscoat and plumbing or other built-in fixtures shall be made with a light-colored calking compound.

15.5 Cleaning: Upon completion, tile shall be thoroughly cleaned in a manner as not to affect the surface. Damaged or defective tiles shall be replaced, at no cost to the Owner.

- End of Section -

SECTION 16 GLASS AND GLAZING

16.1 General Requirements: The work includes the providing of all glass and glazing, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

16.2 Materials:

16.2.1 Glass: All glass shall be 1/4 inch clear polished plate glass, unless otherwise shown.

16.2.2 Putty shall have a plastic consistency and shall be specially manufactured for the intended use. The compound shall adhere tenaciously to the surface to which applied, and shall not shrink excessively and shall be non-staining.

16.3 Installation: Glass shall be cut, where required, with the visible lines or waves running with the horizontal dimensions. All glass shall be well bedded and carefully back putted and for wood sashes etc. It shall be sprung in and fixed with beads. Beads, equally spaced on all four sides, shall be carefully driven into the wood to keep the glass from shifting. Glass in metal windows shall be secured with spring clips and patent mastic. Glass shall be neatly cut to fit the rebates with 1.5 mm. clearance all around the rebates shall be primed before glazing.

16.4 Cleaning: On completion all glass shall be cleaned both sides and any broken, cracked or defective panes shall be replaced at the Contractor's expense to the satisfaction of the Contracting Officer.

- End of Section -

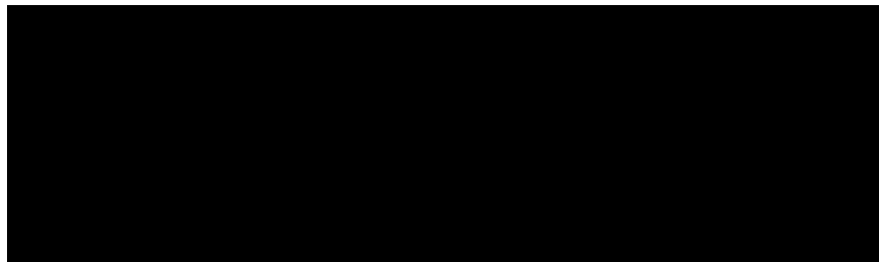
SECTION 17 - CARPENTRY

17.1 General Requirements: The work includes the providing of all carpentry work, complete, in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

17.2 Materials (Lumber):

17.2.1 Lumber shall be heartwood of the following specie (s), (or others as approved); the wood shall be heavy, close-grained and resistant.

25X1A



17.2.2 Moisture Content: All lumber shall not have a moisture content in excess of 20 percent at the time of installation in the structure.

17.2.3 Dimensions: Unless otherwise shown, lumber shall not be shorter than 10 feet (3.3 meters) in length. All lumber shall be surfaced and planed. All finish lumber, after planing, shall not vary from the indicated thickness by more than 10 percent.

17.3 Materials (Other Than Lumber):

17.3.1 Acoustic Tiles shall not be less than 16 mm. thick, with regular or random perforation and beveled face edges. The size and color of units shall be manufacturer's standard.

17.3.2 Nails, Screws and Other Fastening Devices shall be of the proper type and of adequate size to secure the work.

17.3.3 Plywood, unless otherwise shown, shall be 1/4-inch thick, and shall be suitable for paint or varnish finish. Thickness of a single layer of veneer shall be not less than 0.2 mm. Plywood for toilet doors shall be of the water resistant type.

17.3.4 Asbestos-Cement Sheets shall be composed of asbestos fiber and Portland cement. Sheets shall be dense and tough. Units shall be the largest size available for the use intended with thickness as shown. Chipped, cracked or broken sheets shall not be used in the work.

17.3.5 Pentachlorophenol: All wood surfaces in contact with masonry or concrete shall receive two coats of pentachlorophenol preservative treatment by brush application. The final coat will not be applied until the initial coat has dried.

17.4 Samples of all materials other than rough lumber shall be subject to approval prior to delivery to the site.

17.5 Rough Carpentry: Lumber, and other rough work, shall be closely fitted, and accurately set to required lines and levels. Special framing or construction, not indicated or specified, shall be provided as necessary for the proper completion of the work. Members shall be rigidly secured in place with proper size fastenings.

17.6 Interior Carpentry:

17.6.1 Suspended Ceiling System: Ceiling runners and furring shall be hardwood lumber, sizes and spaced as shown, and shall be set level to the required ceiling height.

17.6.2 Ceilings: The edges of ceiling units shall be closely fitted, and the joints shall be in a line both ways perpendicular to the walls. Damaged sheets shall not be used in the work. Units shall be flat and free from any wavy condition prior to fastening.

17.6.2.1 Asbestos Cement Boards shall be pre-drilled for fasteners, holes spaced at 10 inches on centers 3/8-inch from edges and along all bearings. Fasteners may be nails or screws. Nails shall have flat heads and of size and length as will penetrate the bearings not less than 3/4 inch. Screws shall have flat countersunk heads, and shall be No. 9 AWG 3/4 inch long.

17.6.2.2 Acoustic Tiles shall be glued to 1/4-inch thick plywood backing by acoustic tile adhesive. Dirty or discolored surfaces of acoustic units shall be cleaned and left free from defects. Units that are damaged or improperly applied shall be removed and replaced as directed.

17.6.3 Wood Doors and Frames shall be of the type and design shown. Frames shall be set plumb and square and shall be properly anchored to the structure.

17.6.3.1 Hinged Doors shall be of type and design shown.

17.6.3.1.1 Flush Type (Hollow Core): Doors shall have hollow cores of such type as will adequately support the outer plywood and afford strength and stability for the use intended. Doors shall be provided with a lock of sufficient size for the proper installation of intended finish hardware. Veneers for cross banding and face shall be at least 2 or more piles with a combined minimum thickness of 5/16 inch before sanding. Face veneer shall be of approved hardwood. Edge strips shall be tongued and grooved into stiles and rails and properly glued and nailed. All veneers shall be bonded with a water-resistant type adhesive applied to all contact surfaces, and the whole door shall be placed in a gluing press and uniformly pressed.

17.6.3.1.2 Panel Type: Stiles and rails shall be fitted together with open mortise-and-tenon joints, routed to receive panels. Solid wood panels shall not be glued at the edges, but shall be capable of self adjustment within the stiles and rails to prevent splitting. Type of panels shall be as shown.

17.6.3.1.3 Screen Doors shall be as shown. Solid stiles and rails shall be rabbeted on one side, and the insect screen wire shall be stretched tightly and secured in place. The edges of the wire shall be covered with moulding mitered at the corners.

17.6.3.1.4 Louver Inserts in the doors shall be as shown. Louver frame shall have mitered joints, and shall be routed out to receive slats of proper width to provide the edge finish shown. Joints shall be glued.

17.6.3.1.5 Toilet Stall Doors shall be of plywood built up to the 1 1/4-inch thickness.

17.6.3.2 Hanging and Trimming: Doors shall be properly hung with sufficient clearance for proper operation. Doors shall swing horizontally, and shall stand in any position.

17.6.4 Shelves & Work Bench shall conform to details and shall be in unit lengths as required for the location where shown.

17.7 Hardware, as specified under the section entitled Hardware shall be carefully and securely attached. Care shall be taken not to mar existing work. Upon completion of the work keys shall be fitted into their respective locks and shall be demonstrated to work properly.

- End of Section -

SECTION 18 HOLLOW METAL DOORS AND FRAMES

18.1 General Requirements: The work includes the providing of hollow metal doors and door frames shown or required, complete, in strict accordance with the specification and applicable drawings, and subject to the terms and conditions of the contract.

18.2 Materials:

18.2.1 Steel Shapes, Structural shall be of the type shown and shall be standard commercial quality.

18.2.2 Galvanized Iron and Steel, Sheet, Hot-Dip shall be copper-bearing standard commercial quality. Thickness shall be as indicated.

18.2.3 Mastic: Metal to metal joints between member of door, and door frames shall be set in mastic of the type recommended by the door manufacturer and as approved to provide completely watertight joints. Excess mastic shall be removed before it hardens. Calking between metal and masonry or concrete shall be as specified in section entitled Calking.

18.2.4 Metal for door shall be cold-rolled, stretcher-leveled sheet steel and shall have clean smooth surfaces.

18.3 Workmanship: The finish work shall be strong and rigid, neat in appearance, free from defects, warp, or buckle. Molded members shall be clean-cut, straight and true, with joints coped or mitered, well formed, and in true alignment. Exposed welded joints shall be dressed smooth. Exposed screws or bolts, shall have heads countersunk.

18.4 Hollow Metal Doors: Doors shall be flush type, 1 3/4 inches thick and sheet steel of not less than 18 gage and shall be galvanized. Door shall be reinforced for hardware to insure alignment and rigidity. Where practicable joints shall be mitered. All joints shall be thoroughly welded their entire length. Insulating boards (strip cork, air cell asbestos, or wood fiber) shall be fastened properly to reduce metallic ring. Approved astragal metal strip shall be provided for metal double doors. Doors shall be shop galvanized and banded.

18.5 Metal Clad Doors: Door sash shall be constructed conforming to section: Carpentry and shall be covered with galvanized steel sheet gauge 26. Louvers shall be fabricated from 24 gage cold rolled steel with rain-proof blade and shall be galvanized.

18.6 Hardware shall be as specified in section entitled Hardware and shall be furnished and installed at the factory.

18.7 Door Frames shall be formed from sheet steel to sizes and designs shown and shall be galvanized. Allowance shall be not more than 3/32 inch clearance for door at jams and head. Door metal frames 3 feet wide or less shall be not less than 16 gage steel; metal frame wider than 3 feet shall be 14 gage. Corners shall be accurately fitted and welded. All exposed welded joints shall be smooth and invisible when finished. Where practicable, joints shall be mitered, and all miters shall be well-formed and true. All finished work shall be free from warps and buckles. Frames shall be anchored securely to the wall and/or partition construction with 3 galvanized 14 gage T - anchors at each jamb and 2 at head. Floor clips for fastening to the floor and temporary spreaders shall be provided. Door frames and trims shall be shop galvanized and bonderized.

18.7.1 Provisions for Hardware: Frames shall be prepared at the factory for installation of hardware. Frames shall be mortised, reinforced, drilled, and tapped to templates to receive mortised template hinges, lock strikes, and overhead door closers where required, and shall have reinforcing plates for surface-applied hardware. Cover boxes in back of hardware cutouts shall be provided. Adequate reinforcement plates shall be also provided for surface applied hardware for which drilling and tapping is to be done in the field. Location of hardware shall be as specified in section entitled Hardware.

18.8 Installation:

18.8.1 Door Frames shall be installed plumb, straight, and true, rigidly secured in place and properly braced. Where construction will permit, the spreaders used for bracing during shipment shall be left in place and concealed. Spreader that cannot be concealed shall be left in place until the frames are set and anchored. Frames shall be anchored to concrete or masonry with proper size anchoring straps as indicated.

18.8.2 Hinged Door shall be fitted, hung and trimmed with the hardware. Door clearances shall be as hereinbefore specified. After erection, hardware shall be properly adjusted and lubricated to operate freely.

18.9 Protection and Cleaning:

18.9.1 Protection: Care shall be used in handling door, door frames and other items hereinbefore specified during transportation and at the job site. Such items shall be stored at the site on edge and under cover. After installation, they shall be protected from damage during subsequent construction activities.

18.9.2 Cleaning: Metal surfaces shall be cleaned on both the inside and outside of all mortar, plaster, paint, and other foreign matter to present a neat appearance and prevent fouling of weathering. Surfaces of painted items shall be satisfactorily cleaned and touched up. Stained, discolored, or abraded items that cannot be satisfactorily repaired shall be replaced with new items. Abrasive, caustic, or acid cleaning agents shall not be used.

18.10 Shop Drawings shall be submitted for approval.

- End of Section -

SECTION 19 WINDOWS - METAL

19.1 General Requirements: The work includes the providing of standard-stock types and sizes, and of the combinations indicated.

19.2 Material:

19.2.1 Material-Frame, muntin and ventilator members shall be hot rolled, new billet steel bars not less than 1 3/8-inch deep and 1/8-inch. For continuous-welded construction the frame sections of intermediate projected windows may be 1 1/4-inch minimum depth, provided the ventilator sections are 1 1/2-inch minimum depth.

19.2.2 Mullions: Mullions shall be provided between multiple-window units where indicated. Mullions shall be designed to withstand a uniform wind pressure of 20 pounds per square foot without deflecting more than 1/175 of the span for steel. Mullions shall be securely anchored at each end to adjacent construction. Mullions shall be secured to adjacent window units to form a watertight joint and to allow for expansion and contraction. Where indicated, furnish vertical steel mullions and fittings for attaching.

19.2.3 Anchor Clips shall be furnished as indicated.

19.2.4 Hardware: Operating hardware shall be malleable iron or steel, painted or zinc plated. The following hardware shall be furnished.

19.2.4.1 For Project-Out Ventilators, not within reach of floor ring type locking handle with pole ring.

19.2.4.2 Where Ventilators are not within reach of floor, hardware for operation by pole shall be provided. The fastener shall be located in the center of the frame.

19.2.5 Glazing Provision: Window shall be designed for outside glazing, using spring wire clips and steel window glazing compound. All glazing materials shall conform to section: Glass and Glazing.

19.3 Construction:

19.3.1 General: All joints shall be tenoned and riveted. In addition, corners of projected ventilators shall be welded. Weathering members shall be welded to framing bars. Double weathering contact shall be provided for entire perimeter of ventilator. Muntins shall be continuous, interlocked at intersections, and riveted at ends. Projected ventilators shall be balanced at sides on two steel arms attached to ventilator frames by steel arm blocks and steel, shouldered rivets with brass bushings. Each ventilator shall have two brass friction shoes attached with flat steel springs. Shoes shall slide vertically in channels formed by the side weathering with sufficient friction to hold ventilators in any position up to the limit of opening.

19.3.2 Finish: After fabrication, the windows shall be given one of the following finishes.

19.3.2.1 Phosphate treatment and prime coat for windows shall conform to Federal Specification TT-P-636. Finish painting shall be applied after installation to conform to the requirements of section: Field Painting.

19.3.2.2 Factory-applied Enamel Finish shall consist of a thermo-setting primer in which the nonvolatile vehicle shall be based on a mixture of epoxy and phenol formaldehyde resins applied at a minimum dry-film thickness of 0.6 mil. The top coat shall conform to Federal Specification TT-E-489, Class B, and shall be applied at a minimum dry-film thickness of 0.8 mil. The color shall be to the approval of the Contracting Officer. Abraded surfaces shall be touched up with Class A, air-drying enamel as specified for factory finish, color to match original paint.

19.4 Shop Drawings: Shop drawings shall be submitted for approval. Windows shall not be delivered to the project site prior to approval of shop drawings.

19.5 Samples: One complete, full-size sample window of each type proposed for use shall be submitted for approval. Sample shall be complete with hardware, anchors, and other accessories, and shall be finished as specified.

19.6 Installation of Windows:

19.6.1 General: Installation shall be done in accordance with the window manufacturer's instructions, using only skilled window mechanics. Windows shall be set plumb, level, in alignment, and properly braced to prevent distortion.

19.6.2 Window Anchors shall be properly spaced not exceeding 60 cm apart and set in masonry openings during progress of wall construction.

19.6.3 Adjustment: After window installation and completion of glazing and painting, windows and operating hardware shall be adjusted to provide free operation and watertight conditions when sashes are closed and locked.

19.7 Protection and Cleaning:

19.7.1 Protection: Windows shall be stored at the site on edge and under cover. After installation, windows shall be protected from damage during subsequent construction activities.

19.7.2 Cleaning: Metal surfaces of windows shall be cleaned on both the inside and outside of all mortar, paint, and other foreign matter to present a neat appearance and prevent fouling of weathering surfaces, weatherstripping, or the operation of hardware. Abraded surfaces of steel windows shall be satisfactorily cleaned and touched up.

- End of Section -

SECTION 20 - HARDWARE, BUILDERS

20.1 Scope: Furnish and install all builders locks, lock trim, door trim, hinges and miscellaneous builders hardware, complete as required by the drawings and/or hereinafter specified.

20.2 Material and Finishes: Bright bronze or bright brass shall be used throughout except in toilet, where the finish shall be chromium.

20.3 Samples: A sample of each different item of finish hardware, properly tagged and marked for identification, shall be submitted to the Contracting Officer for approval.

20.4 Keys and Keyings: All locks shall have two keys with the lock number stamped upon them with the corresponding number stamped upon the face of the lock. Locks shall be masterkeyed as directed by the Contracting Officer. Three (3) master keys shall be furnished for each master key system.

20.5 Hardware Types:

20.5.1 Hinges:

20.5.1.1 Butt Hinges for Metal Doors: shall be half-mortise, regular weight, wrought bronze, five knuckles and two ball bearings, stainless steel pins, button tips with non-rising loose pins. Loose pin hinges for exterior doors opening out shall be constructed that the pins cannot be removed when doors are closed. Each single door and each leaf of double doors shall be provided with 3-5 inch x 5 inch butt hinges unless specified otherwise.

20.5.1.2 Interior Doors: Interior doors shall have three full mortise brass butt hinges size 5 inches by 5 inches unless specified otherwise. Doors with closers will have ball bearing type hinges.

20.5.1.3 Screen Doors: Each screen door shall be provided with 3 half surface brass spring hinges, with adjustable tension coil spring completely enclosed in cylinder.

20.5.1.4 Toilet Stall Doors: Each toilet stall door shall be provided with 2 brass barrel type spring hinges.

20.5.2 Door Closers: Door closers shall be provided where specified in the hardware set and shall be of the rack and pinion construction, crankshaft construction or rotary-vane construction. Arms and brackets shall be of steel or malleable iron and caps or

plugs shall be of brass or bronze. Plates or brackets shall be of iron or steel and springs shall be fully enclosed. Shaft and pinion shall be of steel with pinion mounted between and adjacent to two shaft bearings. Shaft packing shall be of suitable resilient material, and be either adjustable or preformed to prevent escape of the liquid by capillary action or in other manner. Each closer shall be provided with a hold open feature which provides for automatic hold open and release by push and pull on door, with adjustable holding tension. Medium duty closers shall have a minimum shaft diameter of 9/16 inch and a minimum piston displacement of 2.3 cubic inches. Heavy duty closers shall have a minimum shaft diameter of 5/8 inch and a minimum piston displacement of 3.3 cubic inches.

20.5.3 Lockset and Latchsets:

20.5.3.1 Type 161A-4: One cylinder and turn button. Latch bolt from either side by knob, except when outside knob is locked by turn button in inside knob. Lock may be operated by key or inside knob when outside knob is locked. Latch bolt is automatically deadlocked against end pressure when door is closed. Turn button must be manually operated to release outside knob.

20.5.3.2 Type 161B-4: One cylinder and push button. Latch bolt from either side by knob, except when outside knob is locked by push button in inside knob. Turning inside knob or key automatically releases push button and outside knob. Closing door does not release push button or knob. Latch bolt is automatically deadlocked against end pressure when door is closed.

20.5.3.3 Type 161N-4: Latch bolt by knob from either side at all times.

20.5.3.4 Type 161D-4: One cylinder. Latch bolt by key from outside and knob inside. Outside knob always locked. Latch bolt is automatically deadlocked against end pressure when door is closed.

20.5.4 Automatic Door Holder, Type 1167: Encased spring bumper with metal plunger and stop. Door strike plate with projecting hook to engage hinged-holding tongue on top of bumper. Operation by push on door to the stop position, when engagement in automatic; release by quick push on door. Holding tongue inactive when placed in reverse position.

20.5.5 Push Plates: Push plates shall be plastic, plain design with square corners and beveled edges. Minimum size shall be 14 x 3 inches and .04 inches thick.

20.5.6 Door Pulls and Plates: Pulls shall be wrought brass, plain design with square corners and beveled edges. Plate shall be not less than 14 x 3 inches and .04 inch thick. Grip shall be cast brass, approximately 5 inches center to center.

20.5.7 Lever Extension Flush Bolts shall be cast bronze, plate 6-3/8 inch by 1-1/4 inch minimum. Bolt head, brass 1/2-inch square with length of rod of 12-inches.

20.5.8 Dustproof Strike shall be cast bronze to suit type of bolt. Approximately 1 inch by 2 1/2 inch on face by 2-inch depth, back fully enclosed.

20.5.9 Door Stops shall be cast bronze heavy weight rubber tip with hook and keeper. Projection shall be 3 1/2 inches. Diameter of base shall be approximately 2 1/4 inches.

20.5.10 Swing Latch and Keeper (Toilet Stall Doors) shall be of extra heavy cast or wrought brass with chromium plating. Fastening plate shall be about 2 x 2 inches. Bar shall be not less than 3/4 x 1/4 inch in cross section and not less than 4 inches long and shall have a small finger grip knob.

20.5.11 Hook and Bumper (for Toilet Stall Doors) with rubber tip shall be cast brass with chromium plating. Rubber tip shall be renewable.

20.6 Application of Hardware:

20.6.1 Hinges: Top hinge shall be installed 5 inches from head rabbet to top edge of barrel, bottom hinge 10 inches from bottom edge of barrel to finished floor. For doors with three (3) hinges, the third hinge shall be centered between top and bottom hinges.

20.6.2 Door Pulls: Door pulls shall be installed so that the middle of the grip will be 44 inches above the finish floor.

20.6.3 Locks and Latch Strikes: Locks and latch strikes shall be installed on doors and door frames with the center of door knobs 36 inches above the finish floor and centered not less than 8.3 cm. from edge of door.

20.6.4 Push Plates: Push plates shall be installed so that the bottom of the plate will be 40 inches above the finish floor.

20.6.5 Lever Extension Flush Bolt shall be installed in the edge of the door and located so that the trip mechanism will be about 6 feet from the floor for the top bolt and 12 inches from the floor for the bottom bolt. Where strikes for the bottom bolt are to be installed in concrete they shall be secured with machine screws and lead expansion shields. Strikes located in metal thresholds shall be secured with machine screws, or by welding or brazing as applicable.

20.7 Protection: Hardware shall be boxed per unit and subdivided per room, all to be tagged for its specified location.

20.8 Hardware Sets: The required hardware for each door is specified as follows and has a symbol consisting of the hardware set numbers:

<u>Building</u>	<u>Location</u>	<u>Hardware Set No.</u>
Transmitter Building	Exterior Double Doors to Rm. 101	1
	Exterior Single Door to Rms. 103 and 105	2
	Interior Single Door to Rms. 101, 102 and 106	3
	Interior Single Door to Rms. 102, 103, 104 and 107	4
	Interior Single Door to Rm. 108	5
Power Plant	Exterior Double Doors to Rm. 101	6
	Exterior Double Screened Doors to Rm. 101	7
	Interior Single Door to Rm. 102	5
	Interior Single Door to Rm. 103	4

<u>Hardware Set No.</u>	<u>Quantity</u>	<u>Description</u>
1	1 Each	Lockset, type 161A-4
	2 Each	Lever Extension Flush Bolt
	2 Each	Dustproof strike
	1 Each	Door Closer
2	1 Each	Lockset, Type 161A-4
	1 Each	Door Closer
3	1 Each	Lockset, Type 161B-4
	1 Each	Door Closer
	1 Each	Door Stop (where required)

<u>Hardware Set No.</u>	<u>Quantity</u>	<u>Description</u>
4	1 Each	Lockset, type 161N-4
	1 Each	Door Closer
	1 Each	Door Stop (where required)
5	1 Each	Lockset, type 161D-4
	1 Each	Door Closer
	1 Each	Door Stop
6	1 Each	Lockset. Latch bolt by knob from outside and by thumb turn inside, except when outside knob is locked by key in outside knob. Inside thumb turn always free. Latch bolt deadlock against end pressure when door is closed.
	2 Each	Lever Extension Flush Bolt
	2 Each	Dustproof Strike
	2 Each	Automatic Door Holders
7	3 Pairs	Spring Hinges
	2 Each	Door Pull
	2 Each	Push Plate

Toilet Stall Doors

1 Each	Swing Latch and keeper
1 Each	Hook and bumper

- End of Section -

SECTION 21 - MISCELLANEOUS METAL WORK

21.1 General Requirements: The work involves the providing of all miscellaneous metal work not elsewhere specified, complete in strict accordance with the applicable drawings and specifications, and subject to the terms and conditions of the contract.

21.2 Materials:

21.2.1 Trench Cover Plate shall be galvanized steel checkered plate, thickness as indicated and fabricated as shown. Frame shall be galvanized steel angles 2 1/2 inches by 2 1/2 inches by 1/4 inch with 3/8 inch diameter bent anchor bars cast in place at the same time with the concrete.

21.2.2 Steel Pipe Handrail and Bolluster shall be fabricated of galvanized steel pipe, 1 1/2-inch nominal diameter. Connections shall be welded and carefully made, ground smooth and flush with the finish surface. Bends, where required, shall be carefully made to uniform radii, without kinks and without distortion of the circular section of the pipe. Posts shall be set in galvanized steel sleeves embedded in the concrete, tightly wedged in place and caulked using molten lead. All damaged galvanizing shall be repaired and painted with a touch-up of galvanize paint.

21.2.3 Thresholds shall be furnished and installed for all door openings which are indicated to have thresholds. Thresholds shall be extruded aluminum of designs shown and shall be secured to floors with expansion anchors and flat head counter-sunk machine screws not over 10 inches apart or other approved fastenings. Threshold shall receive an abrasive non-slip finish.

21.2.4 Drain Sump Steel Grating shall be galvanized steel and fabricated as shown. Frame shall be galvanized steel angle 2 inches by 2 inches by 1/4 inch thick with 1/2 inch diameter anchor bolts spaced at 8 inches on center. Grating shall be galvanized steel flat bars, 1 inch by 1/4 inch welded at 1 inch on center to the frame.

21.2.5 Exhaust Pipe thru roof slab shall be constructed as shown on plan. Flashing shall be 3/16 inch thick steel plate, galvanized and welded to the pipe.

21.3 Installation: The miscellaneous metal work shall be positioned as shown, and securely anchored in place. Items which are to be positioned in the forms prior to

placing of concrete shall be so fastened in place to ensure stability during concrete placing operation.

21.4 Steel Lockers shall be double tier 12 inches wide, 18 inches deep and 78 inches high made from mill cold rolled sheet steel gauge 24 and free from imperfections.

21.4.1 Finish All parts shall be cleaned before painting and given a bonding and rust-resisting phosphate under coat followed by one coat of high-grade sprayed enamel. Hardware shall be cadmium plated.

21.4.2 Door Frame shall not be less than 16 gauge formed to a channel shape. Vertical members shall have an additional flange to provide a continuous door strike. Intermembering parts shall be electrically welded together in a rigid assembly.

21.4.3 Doors shall be one piece 16 gauge, flanged on all edges to provide strength and stiffness. Doors shall have channel formation on vertical edges and shall be provided with louvers.

21.4.4 Locking Device shall be the positive automatic type where locker door may be locked when open, then closed without unlocking. Rubber bumpers shall be provided for quiet operation of door. Provision for locking by padlock for door shall be provided.

21.4.5 Door Handle shall be zinc alloy die casting, chromium plated. Handle shall have internal lifting piece operated by finger pressure to release locking bar. Padlock eye shall be an integral part of the handle.

21.4.6 Hinges shall be 0.050-inch thick full loop tight pin, five knuckle hinges 2-inch high, projection welded to door frame and bolted to door. Door shall have two hinges.

- End of Section -

SECTION 22 - SHEET METAL WORK

22.1 General Requirements: The work includes the providing of all sheet metal, complete, in strict accordance with the specification and applicable drawings, and subject to the terms and conditions of the contract.

22.2 Materials:

22.2.1 Galvanized Iron and Steel shall be copper-bearing. Except as otherwise specified or indicated, sheets shall be not lighter than 24 gage.

22.2.2 Solder shall conform to Federal Specification QQ-S-571c (2), composition 550.

22.2.3 Soldering Flux not otherwise specified shall be rosin, and, where conditions of application prohibit use of rosin, flux conforming to Federal Specification O-F-506b shall be used.

22.3 Installation:

22.3.1 General: Surface to which sheet metal is to be applied shall be even, smooth, sound, thoroughly clean and dry, and free from all defects that might affect the application. All accessories or other items essential to complete sheet-metal and miscellaneous metal installation, though not specifically shown or specified shall be provided. Standard commercial products which meet the general requirements of the drawings and specifications will be acceptable. Welding shall be continuous along entire line of contact except where tack welding is authorized. Tack welding will not be permitted on exposed surfaces. Exposed welds shall be ground smooth. Steel shall be clean and free from mill scale, flake rust or pittings. Nails, brads, clips, and so forth for ferrous metal shall be galvanized iron or steel. All items shall be installed plumb, straight, square, level, at their proper elevation and location, and in proper alignment with adjacent work.

22.3.2 Soldering: All edges of uncoated sheet metal to be soldered shall be pre-tinned before soldering is begun. Soldering shall be done slowly with well-heated irons so as to heat the seam thoroughly and sweat the solder completely through the full width of the seam. Ample solder shall be used and the seam shall show not less than one full inch of evenly flowed solder. Soldering shall follow immediately after application of flux. Upon completion of soldering, acid shall be neutralized and surfaces shall be cleaned thoroughly.

22.3.3 Seams: Flat lock seams shall be finished not less than 19 mm. wide, soldered lap seams not less than 25.4 mm. wide and unsoldered lap seams not less than 101.6 mm. wide.

22.4 Flashing shall be copper or zinc coated sheet metal as shown on the drawings and shall be installed at all intersections of roofs with vertical surfaces, at all projections through roofs to provide watertight protection. Exposed edges of all flashings shall be folded back 1.5 centimeters of provide stiffness.

22.5 Welding shall be performed by qualified welders. Care shall be taken to prevent crawling or distortion through welding heat and to maintain alignment.

22.6 Louvers shall be of galvanized steel, formed to shape as indicated. Steel sheets shall be heavily zinc-coated. The blades and frames shall be 24 gage. The edges of lower blades shall be folded and beaded for rigidity and baffled to exclude driving rains. Lower blades with fins shall be tenoned or welded to the frames and entire assembly built into the wall. Louvers shall be provided with insect screen as indicated.

22.7 Downspouts shall be constructed of 24 gage galvanized steel sheet, size as indicated, and shall be provided in sections approximately 3.00 m long with flat-lock seams. Downspouts shall be set plumb and clear of wall and shall be firmly secured to the supporting construction by 5 cm. wide, 24-gage galvanized steel straps attached to the downspout. Two straps shall be provided for each section of downspout, located near the top and bottom. Elbows, offsets and shoes shall be provided where indicated. Basket strainers of 9-gage non-corrosive wire shall be set in loosely at conductor head openings into downspouts. Conductor head shall be fabricated and installed as shown.

- End of Section -

SECTION 23 - THERMAL INSULATION

23.1 General Requirements: The work includes the providing of thermal insulation, complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

23.2 Applicable Specifications and Standards:

23.2.1 Federal Specifications:

AS-1-666(1) Asphalt:(for) built-up roofing, water proofing, and damp-proofing.

23.2.2 ASTM (American Society for Testing and Materials, 1916, Race Street, Philadelphia).

C177-63 Thermal conductivity of materials by means of the guarded hot plate.

C272-53 Water absorption of core materials for structural sandwich construction.

D36-62T Softening points of asphalts and tar pitches (ring and ball apparatus).

D41-61T Primer for use with asphalt in damp-proofing and waterproofing.

D113-44 Ductility of bituminous materials.

D816-55 Rubber cements

D1621-59T Compressive strength of rigid cellular plastics.

D2126-62T Resistance of rigid cellular plastic to simulated service conditions.

D84-61 Surface burning characteristics of building materials.

23.2.3 UL: (Underwriters' Laboratories, Inc. 207 East Ohio
Chicago II, Illinois).

UL 723 Test method for fire hazard classification
of building materials (August 1960).

23.2.4 ASHRAE: (American Society of Heating, Refrigerating and
Air-Conditioning Engineers, Inc., 234 Fifth
Avenue, New York 1, N. Y.)

Guide and Data Book, Applications (1964)

Guide and Data Book, Fundamentals and Equipment (1963)

23.3 General: In the application of the insulation, asphalt shall be used with asphalt-saturated felts. Asphalt shall not be heated above 450 degree F. The wall and roof shall be dry when the insulation is applied. Bitumen shall be hot when applied in masonry walls. Materials shall be stored in an approved manner and shall be protected from contact with soil and from exposure to the elements.

23.4 Materials:

23.4.1 Bitumen for Applying Insulation shall conform to Federal Specification SS-A-666, type III, 190-200F. softening point. Softening point and ductility test methods for asphalt shall be in accordance with ASTM Designation D36 and D113, respectively.

23.4.2 Insulation shall be of the following material. Insulation used on wall and roof exclusive of covering, shall have a flame-spread rating not to exceed 25 when tested in accordance with ASTM Standard 1584 or UL Standard 723; the rating is not required when insulation is applied in non-flammable adhesive.

23.4.2.1 Polystyrene Foam and Board-type Insulation shall be locally manufactured and conforming to the following:

23.4.2.1.1 Conductivity shall not exceed 0.24 B.t.u. per hour per square foot per degree F. per inch temperature difference at a mean temperature of 75 degrees F. when tested in accordance with ASTM Standard C177-63.

23.4.2.1.2 Compressive Strength shall not be less than 30 pounds per square inch when the board is compressed to a deformation of 5 percent of its original thickness when tested in accordance with ASTM Standard D1621-591, modified to change its drying temperature to 150 degrees F.

23.4.2.1.3 Dimensional Stability shall be no more than plus or minus 2 percent change in any direction of the specimen when tested in accordance with ASTM Standard D2126-62T, Procedure E, except that the duration of exposure shall be 7 days.

23.4.2.4 Moisture Absorption shall not exceed 2.5 percent by volume when tested by the immersion method in accordance with ASTM Standard C272-53, using drying oven at the temperature of 122 degrees F. plus or minus 5.4 degrees, except that on removal from immersion the specimen shall be placed on edge with the direction of the thickness perpendicular to the air stream in precision oven at 120 degrees F. for 10 minutes.

23.4.3 Samples of all materials shall be submitted to Contracting Officer prior to being incorporated in the work.

23.5 Surface Preparation:

23.5.1 General: The entire wall and roof construction of the building shall be completed before installation of the insulation is started. The wall and roof surface shall be dry, smooth, firm, and free from dirt, projections, and foreign materials. Vents and other items penetrating the wall and roof shall be secured in position and properly prepared for flashing. Wall on which bitumen-applied insulation is installed shall be tested for dryness and approved for installation of materials immediately prior to starting work.

23.5.2 Test for Dryness: The wall surface shall not be considered dry and application shall not be started until the following conditions are met. A minimum of 1 pint of bitumen shall be used on a representative area of the wall.

23.5.2.1 Foaming: When poured on the wall surfaces, the bitumen heated to 350 to 400 degrees F., shall not foam upon contact with the wall surfaces.

23.5.2.2 Strippability: After the bitumen used in the foaming-test application has cooled to ambient temperature, the coating shall be tested for adherence to the surfaces applied. Should any portion of the sample be readily stripped clean from the wall surfaces shall not be considered dry, and application shall not be started.

23.6 Application of Polystyrene Foam and Board-type Insulation:

23.6.1 Insulation: Wall insulation shall be laid in one or more layers in hot bitumen applied at the rate of at least 20 pounds of asphalt per square for solid mopping. Units of insulation shall be laid in parallel courses with joints broken, in moderate contact with adjoining units without forcing, and cut to fit neatly against adjoining surfaces. Successive layers shall be applied in solid mopping of bitumen, and joints shall be staggered with respect to joints in preceding layer. Edges and ends of foam slabs shall be buttered with asphalt bitumen and butted together. Joints between insulation units shall not occur over openings in wall or roof. The insulation shall be kept dry at all times and shall be laid before other face of masonry wall is laid. Roof board-type insulation may be secured to the roof direct in strip-applied, non-flammable adhesive. The adhesive shall be applied in parallel strips spaced not over 6 inches on centers using not less than 1/2 gallon of adhesive per square per layer of insulation. No more insulation shall be laid that can be covered the same day. Exposed edges of the insulation shall be protected by cut-offs at the end of each day's work. Cut-offs shall be two layers of felt hot mopped not less than 4 inches on complete work.

- End of Section -

SECTION 24 - WATER STORAGE TANK, ELEVATED

24.1 General Requirements: The work includes the providing of an elevated water tank, complete in strict accordance with the specifications and the applicable drawings and subject to the terms and conditions of the contract.

24.2 Tank shall be welded construction of 3/16 inch steel plate body and 1/8 inch steel plate cover with a capacity of 9,000 gallons, connected as shown. Fittings, valves and appurtenances shall be provided as indicated. Connecting piping shall be standard weight galvanized steel pipes.

24.2.1 Float Valves shall be brass body, brass mounted valves suitable for the application shown.

24.2.2 Steel Ladder shall be constructed of 1 1/4 by 2-inch steel flat bar and 5/8-inch round steel bar rungs, drilled and welded to the flat bars, spaced at 30 centimeters on center. The flat bars shall be welded to the side of the steel tank.

24.3 Tower shall be constructed as shown, closely fitted, accurately set to the required lines and levels, and shall be bolted and nailed in a thorough manner with bolts and nails of ample size. Materials and workmanship shall be in accordance with Section entitled Carpentry. Concrete footings for the tower shall be in accordance with Section entitled Concrete for Structures.

24.4 Painting of the water storage tank shall be in accordance with the section entitled Field Painting.

24.5 Cleaning and Testing: After erection, the interior of the tank shall be cleaned and filled with water, and demonstrated to be watertight.

- End of Section -

SECTION 25 - PLUMBING

25.1 General Requirements: The work includes the providing of interior plumbing, complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

25.1.1 Standard Products: Material and equipment to be provided shall be the standard products of manufacturers regularly engaged in the manufacture of products conforming to these specifications, and shall essentially duplicate material and equipment that have been in satisfactory use not less than 2 years.

25.1.2 Deviations From Specifications: The product of any reputable manufacturer regularly engaged in the commercial production of the specified material and equipment will not be excluded on the basis of minor differences, provided all essential requirements of this specification relative to materials, capacity, and performance are met. A statement shall be furnished to the Contracting Officer giving a complete description of all points wherein the plumbing equipment he proposes to furnish does not comply with the specifications.

25.1.3 Specifications: Shop tests of pipe, valves and fittings required by Federal Specifications to be conducted in the presence of a Government Inspector are waived.

25.1.4 Termination of Water and Drainage Piping: Where shown, water and drainage piping shall be extended to points 5 feet (150 cm) outside the building, where the pipes shall be capped or plugged for future connection, or for connection under other sections of this specification.

25.2 Applicable Specifications and Standards:

25.2.1 Federal Specifications:

NH-C-536a	Compound, Plumbing-Fixture-Setting.
NH-G-116	Gaskets; Plumbing-Fixture-Setting.
NH-P-117	Packing, Jute, Twisted.
QQ-L-156	Lead Caulking.
QQ-L-201d	Lead; Sheet.

WW-P-401c	Pipe and Pipe Fittings; Soil, Cast-Iron.
WW-P-406b	Pipe, Steel (Seamless and Welded) (for Ordinary Use).
WW-P-441b(1)	Pipe; Wrought Iron (Welded, Black or Zinc-Coated).
WW-P-491a(1)	Pipe Fittings; Cast-Iron, Drainage.
WW-P-501c(1)	Pipe Fittings; Cast-Iron, Screwed 125-and 250-Pound.
WW-P-521d(1)	Pipe Fittings, Malleable Iron, Wrought Iron and Steel, (Screwed), 150-Pound.
WW-P-541b(4) (Int. Amd. 5)	Plumbing Fixtures, Land Use.
WW-V-51a(2)	Valves Bronze; Angle, Check and Globe 125 and 150 Pound, Screwed and Flanged (for Land Use).
WW-V-54(2)	Valve, Gate, Bronze, 125 and 150 pound, Screwed and Flanged (for Land Use).

25.2.2 ASTM: (American Society for Testing Materials, 1916 Race Street, Philadelphia 3, Pennsylvania)

A 74-42 Coal Tar Pitch Varnish

25.2.3 NBS: (National Bureau of Standards, Superintendent of Documents, Government Printing Office, Washington 25, D.C.)

Handbook H23 Thread Standards

25.3 Materials:

25.3.1 Caulking Lead shall conform to Federal Specification QQ-L-156.

25.3.2 Fittings:

25.3.2.1 Cast-Iron Soil Pipe Fittings shall conform to Federal Specification WW-P-401c, class 8.

25.3.2.2 Drainage Fittings shall conform to Federal Specification WW-P-491a(1), Type III.

25.3.2.3 Malleable-Iron Fittings shall conform to Federal Specification WW-P-521d(1), Type II.

25.3.2.4 Plumbing Fixtures shall conform to Federal Specification WW-P-541b(1) (GSA-F55).

25.3.2.5 Plumbing-Fixture-Setting Compound shall conform to Federal Specification HH-C-536a.

25.3.2.6 Plumbing-Fixture-Setting Gaskets shall conform to Federal Specification HH-G-116, of type best suited for the use intended.

25.3.3 Pipe and Tubing:

25.3.3.1 Cast-Iron Soil Pipe shall conform to Federal Specification WW-P-00401c; coating shall be coal tar pitch varnish conforming to ASTM A 74-42.

25.3.3.2 Steel Pipe shall conform to Federal Specification WW-P-406b, standard weight, class 2 (zinc-coated).

25.3.3.3 Sheet Lead shall conform to Federal Specification QQ-L-201d.

25.3.3.4 Twisted Jute Packing shall conform to Federal Specification HH-P-117, Type II.

25.3.4 Valves:

25.3.4.1 Globe Valves, bronze, shall conform to Federal Specification WW-V-51a(2), Type I, class A.

25.3.4.2 Gate Valves, bronze, shall conform to Federal Specification WW-V-54(2), Type II, class A.

25.3.5 Air Chambers shall be as shown. Where not shown, air chambers shall consist of a 12 inch (30 cm.) length of pipe or tubing of the same diameter as the branch supply and properly fitted with a cap on the top.

25.3.6 Excavation, Trenching and Backfilling shall conform to the requirements of Section: Earthwork.

25.4 Sanitary (Waste, Soil and Vent):

25.4.1 Underground: Piping shall be service-weight bell-and-spigot cast-iron soil pipe and fittings.

25.4.2 Aboveground: Piping shall be zinc-coated standard-weight screw-jointed steel pipe with galvanized threaded malleable-iron or cast-iron recessed-and-banded screw-jointed drainage fittings. Long radius fittings shall be used except where short radius are specifically permitted; close connections may be made up with galvanized threaded malleable-iron or cast-iron drainage fittings.* Fittings on dry vents may be malleable-iron or cast-iron.

25.5 Water Piping:

25.5.1 Water Piping shall be steel pipe, standard-weight, screw-jointed zinc-coated, with 125 pound zinc-coated cast-iron fittings or zinc-coated malleable-iron fittings.

25.5.2 Water Valves shall be provided on all supply lines to fixtures and equipment and where shown.

25.5.2.1 Gate Valves: All shut-off valves shall be gate valves. Gate valves of sizes 2 inches (50 mm.) and smaller shall be bronze with screwed ends.

25.5.2.2 Globe Valves shall be provided where shown.

25.5.2.3 Air Chambers shall be provided where shown, and where not shown shall be provided on cold supplies near each faucet or control valve.

25.5.2.4 Unions shall be provided on the discharge side of all valves and at the final connections to fixtures and equipment, except where the trim of the fixture or equipment permits easy removal of the connection.

25.6 Installation of Piping and Fixtures:

25.6.1 Cross Connections and Interconnections: The equipment or piping shall be installed so that it will not provide a cross connection or interconnection between a distributing supply for drinking or domestic purposes and a polluted supply such as a drainage system or a soil or waste pipe that will permit or make possible the backflow of sewage, polluted water or waste into the water supply

system. Where necessary to cross a sewer or waste line with a water line, the water line shall be above the sewer line not less than 12 inches (30 cm.) and the sewer line shall be cast iron soil pipe for not less than 10 feet (300 cm.) on each side of the crossing.

25.6.2 Appearance: All piping shall be installed in an appropriate manner to present a neat and orderly appearance, using fittings for all changes of direction, and arranging pipe runs parallel to or at right angles to structural members of the building, to provide utmost headroom and to clear lights and other obstructions. In general, install suspended piping as close as possible to the overhead structure.

25.6.3 Workmanship: All pipe shall be cut accurately to measurements established at the site, and shall be worked into place without springing or forcing. Piping shall be installed so that it may expand and contract freely without injury to itself or other work. Steel and wrought iron pipe shall be cut with pipe cutters and shall be threaded with sharp, clean dies. All cut sections of pipe shall be reamed to remove all burrs and to restore the pipe to full diameter. All changes in direction shall be made with fittings, and all changes in size shall be made with reducing fittings. Pipe bends and bushings are prohibited.

25.6.4 Location of Devices: All valves, cleanouts, equipment, accessories, and devices shall be located so that they are accessible for repair and replacement.

25.6.5 Protection: Pipe openings shall be closed with caps or plugs during installation. Fixtures and equipment shall be lightly covered and protected against damage. The inside of each trap, valve, fitting, section of pipe, and fixture shall be inspected and thoroughly cleaned before installation. At the completion of the work, fixtures, materials and equipment shall be thoroughly cleaned and delivered in a satisfactory condition.

25.6.6 Cutting and Repairing: The work shall be carefully laid out in advance. Cutting of construction shall be done only with specific approval. Cutting shall be done carefully, and drainage shall be repaired by skilled mechanics of the trade involved.

25.6.7 Invert Elevations: The Contractor shall verify the proposed invert elevations prior to laying pipe.

25.7 Soil, Waste and Drain Piping:

25.7.1 Slope: Horizontal lines shall be installed with a minimum slope in the direction of flow of 1/4 inch per foot (2 cm. per meter), unless otherwise shown or required.

25.7.2 Fittings: All changes in pipe size shall be made with reducing fittings or recessed reducers. All changes in direction shall be made with "Y" fittings, combination Y and 1/3 bends, long sweep 1/4 bends, 1/8, 1/3 and 1/16 bends; except that sanitary "Tee" branches may be used in vertical stacks, short sweep 1/4 bends may be used when the direction of flow is from a horizontal line into a vertical line, and short sweep 1/4 bends may be used on the discharge from a water closet. Union connections shall be made with tucker or hub drainage fittings.

25.8 Vent Lines:

25.8.1 Slope: Horizontal lines shall be pitched to drain back to the drainage system without forming traps using fittings as required.

25.8.2 Arrangement: Except where otherwise indicated, main vertical soil and waste stacks shall be extended full size to and above the roof line as vents. Where practicable, two or more vent pipes shall be connected together and extended as one pipe through the roof. Vertical vent pipes may be connected into one main vent riser above vented fixtures. Unless indicated otherwise, sanitary piping shall form circuit or loop vents with no dead ends or inverted siphons. Circuit or loop vent lines shall be connected at a height of not less than 12-inches (30 cm.) above the highest fixture served. Horizontal waste lines receiving the discharge from two or more fixtures shall be provided with and vents unless separate venting of fixtures is shown. Where a vent is taken from a horizontal drain line, the vent connection shall be made above the centerline of the drain, either on the top or at an angle of not more than 45 degrees from the vertical. Connect the bottoms of vent stacks so that any dirt or scale from the inside of the stacks will be flushed out through the soil or waste piping. All vent stacks shall be extended a minimum of 12-inches (30 cm.) above the roof, and shall be equipped with a flashing fitting.

25.9 Water Lines:

25.9.1 Slope: All piping shall be installed with a pitch to drain; where branches are connected to vertical risers, each branch shall drain back to its respective riser. Provide drain valves at all low points of the system to permit complete draining.

25.9.2 Take-Offs: Branches from service lines may be taken off the top, bottom or side of the main, using such crossover fittings as may be required by conditions.

25.9.3 Unions shall not be concealed in walls, ceiling or partitions. Unions shall not be covered with insulation.

25.10 Joints:

25.10.1 Joints for Cast-Iron Pipe, hub or bell-and-spigot, shall be made by tightly packing and caulking oakum gaskets or braided or twisted jute into the annular space between spigot and hub or bell to within 1 1/2-inch (3.75 cm.) of the face of the hub or bell, and filling the remaining space with molten lead at one pouring. The lead shall then be caulked to produce a watertight joint without overstraining the hub or bell. When finished, the lead shall be flush with face of the hub or bell.

25.10.2 Joints for Threaded Pipe shall be made with an approved graphite compound applied to the male threads only, and the joint made up tight with not over two full threads showing. Threads exposed after joints are made up shall be mopped with compound. Threads shall be clean cut, tapered threads and the ends of all pipe shall be reamed before installation.

25.11 Hangers and Supports: All piping shall be securely supported. Horizontal runs of piping shall be supported by adjustable clevis type hangers and solid rods securely attached to the building structure. Where several pipes run parallel, trapeze hangers may be used in lieu of separate hangers. All hangers shall have turnbuckles or other approved means of adjustment. Where pipes, such as those from individual toilet rooms to main stacks are not low enough to permit the use of turnbuckles, other means of adjustment shall be used. Chain, strap, perforated bar, or wire hangers will not be accepted.

25.12 Sleeves of proper size shall be furnished and installed where pipes specified under this section of the specification are to pass through footings, floors, walls, partitions, and ceilings. For a group of pipes passing through a floor, an opening may be used in lieu of separate sleeves; such openings shall be properly reinforced. Sleeves in concrete construction shall be installed in the form work before the concrete is poured. Sleeves in masonry construction shall be installed at the time required by the masons.

25.12.1 Diameter of Sleeves: The inside diameter of sleeves shall be not less than 1/2-inch (1.3 cm.) larger than the outside diameter of the pipe, except where pipes pass through footings or bearing walls, sleeves shall be not less than 6-inches (15.3 cm.) larger than the pipe.

25.12.2 Material: Sleeves in footings shall be of cast iron pipe. Sleeves in bearing walls or partitions shall be of cast iron, wrought iron, or steel pipe. Sleeves in concrete shall be wrought iron or steel pipe. Sleeves in floors in concealed spaces and for closet bends shall be of galvanized sheet steel weighing not less than 0.90625 pounds per square foot (No. 26 gauge). Sleeves in floors exposed in finished rooms shall be of wrought iron or steel pipe.

25.12.3 Sleeves in Floors shall extend 1 inch above the rough floor, and after installation of the pipe, the space between pipe and sleeve shall be packed with plastic material and made watertight.

25.13 Floor, Wall and Ceiling Plates: Furnish and install plates on all entry and exit openings for all exposed pipes passing through finished walls, finished partitions, finished ceilings, and floors above grade. Plates shall be large enough to completely close the hole around the pipe. Wall and ceiling plates shall have set screws; spring clips will not be acceptable. Where necessary to cover heads of fittings, special deep escutcheons shall be provided.

25.13.1 Flashings: Vent pipes shall be flashed and made watertight at the roof with 4-pound sheet lead. Flashings shall extend not less than 3 inches from the vent pipes in all directions and shall extend up the vent pipe not less than 6 inches (15.3 cm.) at which point threaded standard cast-iron or malleable-iron recess roof couplings shall be installed to form counter-flashing or rain guards.

25.14 Valves:

25.14.1 Location and Type: The location of the principal valves shall be as indicated on the drawings but, whether or not so indicated, shut-off gate valves shall be furnished and installed in each supply main where it enters the building. All valves used for pipe or equipment drains shall be globe type. All valves shall be installed in accessible locations or access panels shall be provided. No valve shall be installed with its stem below the horizontal. All valves shall be rated for 125 pounds per square inch working pressure or more, unless otherwise shown on the drawings.

25.15 Traps: Furnish and install a trap on each fixture and piece of equipment requiring connection to the sewer system, except fixtures or equipment having an integral trap or seal. Each trap shall be placed as close to the fixture as possible and no fixture shall be double trapped. All traps which are installed in accessible locations shall have cleanout plugs or other approved means for cleaning. Slip joints in-traps will be permitted only on the inlet side or in the trap seal.

25.16 Floor Cleanout shall have an iron body ferrule with raised, square-head brass plug or with spanner wrench sockets.

25.17 Floor Drain shall be of cast-iron and shall be provided with trap, grate and round removable cast brass strainer.

25.18 Plumbing Fixtures:

25.18.1 General: Furnish and install the plumbing fixtures where indicated on the drawings complete with all trim and fittings necessary for proper installation and operation. All fixtures, except water closets, shall have the water supply above the rim. Angle stops, straight stops, stops integral with the faucets, or concealed type of lock shield loose-key stops for concealed supplies shall be furnished and installed for all fixtures. Exposed traps and supply pipes for all fixtures and equipment shall be connected to the rough piping systems at the wall unless otherwise specified or indicated, and shall be equipped with escutcheons where they enter the wall.

25.18.2 Water Closet, Western Type shall be vitreous china, elongated bowl, open front seats (men's toilet). Connections between earthenware of water closets and floor flanges on soil piping shall be made absolutely gastight and watertight with fixture setting compound or fixture setting gaskets as specified herein. Rubber gaskets and putty will not be accepted.

25.18.3 Lavatory shall be wall hung type, vitreous china with straight front complete with cast brass P-trap, cleanout and angle stop valve.

25.18.4 Urinal shall be wall hung type, vitreous china with flat back, complete with cast brass P-trap, cleanout and spring loaded self closing valve.

25.18.5 Service Sink shall be enameled cast-iron with roll rim and plain back, concealed hanger, acid resisting porcelain enameled inside only, and complete with faucet, drain plug, P-trap or S-trap and cleanout.

25.19 Toilet Accessories:

25.19.1 General: Toilet accessories shall be of stout construction. Accessories shall be anchored on wall and mounted on back plates when required. Accessories installed without back plates shall have concealed fastenings wherever practicable. When their location is not specifically indicated or specified, they shall be installed where directed.

25.19.2 Samples: One sample of each accessory proposed for use shall be submitted for approval.

25.19.3 Fastenings: Except as hereinafter specified, accessories anchored on wall shall be installed by means of screws driven into lead or fiber sleeves; by means of metal screws in metal casing; by means of special brackets or extensible lugs, according to the requirements of the construction. Backplates for surface mounted accessories shall be installed in the same manner or shall be provided with lugs or anchors as required by the construction. Mirrors shall be securely anchored and installed only after walls to which they are to be attached have been finished.

25.19.4 Mirrors: A mirror with chromium plated metal frame, designed as shown shall be installed above each lavatory.

25.19.5 Shelves: A shelf as shown, and fastened by means of brackets and wood screws shall be installed above each lavatory and below the mirrors.

25.19.6 Toilet Paper Holder: shall have metal brackets with wood roller for surface mounting. Bracket shall be one-piece chromium plated metal. Roller shall be 2.5 cm. in diameter. Minimum length of roller shall be 12.7 cm. and spaced 3.6 cm. from face of wall and/or bracket.

25.19.7 Paper Towel Dispenser: shall conform to Federal Specification WW-P-541b(4), Type 445.

25.20 Testing:

25.20.1 General: Soil, waste, vent and water piping systems shall be tested; soil or waste piping located underground shall be tested before backfilling.

25.20.2 Drainage Systems:

25.20.2.1 Water Test: The rough piping system for drainage and venting shall have all openings plugged to permit the entire system to be filled with water to the level of the highest vent above the roof. The system shall be filled with water and shall hold this water for 30 minutes without showing a drop in water level of more than four inches. If a portion of the system is to be tested, the test shall be conducted in the same manner as specified for the entire system, except that a vertical stack shall be installed 10 feet (3 m.) above the portion to be tested to provide sufficient pressure, or a pump may be used to provide the required pressure.

25.20.2.2 Water Systems: Upon completion of the roughing-in and before setting fixtures, the entire water piping systems shall be tested at a hydrostatic pressure of not less than 100 pounds per square inch (7.04 Kg per square cm.) for not less than 30 minutes and shall be proved tight at this pressure. When a portion of the water piping system is to be concealed before completion, this portion shall be tested separately in the same manner.

25.20.2.3 Defective Work: If tests or inspection disclose defects, such defective work or materials shall be removed and replaced and the tests and inspections repeated. Repairs to piping shall be made with new materials. No caulking of holes or screwed joints will be acceptable.

25.21 Cleaning and Adjusting: At the completion of the work, all parts of the installation shall be thoroughly cleaned. All equipment, valves, fittings, etc., shall be cleaned of grease, dirt, metal cuttings, sludge, etc., which may have accumulated. Any discoloration or other damage to parts of the building, or its finish or furnishing, due to the failure to properly clean the piping system shall be repaired without additional cost to the Government. Valves and other parts of the work shall be adjusted for quiet operation.

25.22 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the Contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. In addition, the Contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performing satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

- End of Section -

SECTION 26 - SANITARY SYSTEM

26.1 General Requirements: The work includes the providing of a sanitary system, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

26.2 Applicable Specifications and Standards:

26.2.1 Federal Specifications:

WW-P-401c

Pipe and Pipe-Fittings, Cast-Iron, Soil

26.3 Materials:

26.3.1 Concrete: Concrete for septic tanks, manholes and concrete headwall and similar items shall conform to Section: Concrete Work.

26.3.2 Cast Iron Pipe and Fittings, piping out of the septic tank and into the leaching pits shall conform to Federal Specification WW-P-401c, Class XM.

26.3.2.1 Joint Packing shall be of braided or twisted hemp or oakum of best commercial grade.

26.3.2.2 Lead for joints shall contain not less than 99.0 percent metallic lead.

26.3.3 Vitrified Clay Pipe where shown shall be standard strength clay sewer pipe manufactured from surface clay, fire clay, shale, or a combination of these materials. The materials or any combination thereof, when molded into pipe and subject to suitable temperatures, shall yield a product that will be strong, durable, serviceable, and free of objectionable defects. The glaze shall consist of a continuous layer of salt glaze substantially free from large blisters. Not more than 10 percent of the inner surface of any pipe barrel shall be bare of glaze except the socket, where it may be entirely absent. There shall be no well defined network of glazing lines or hair cracks. The ends of the pipes shall be square with the longitudinal axis.

26.3.4 Vitrified Clay Wye Branches, Cleanouts and Fittings shall be of quality not less than that specified for vitrified clay pipe.

26.3.5 Joint Packing shall be jute, hemp, or asbestos fibre, square braided or tightly twisted. The packing shall contain no material that would coat the pipe so as to adversely affect the adhesion of the joint sealer.

26.3.6 Joint Sealer shall be bituminous, mineral filler, hot-pour type. Compounds for the sealer shall consist essentially of asphalt or coal-tar pitch with an inert mineral filler. The material shall be free from water, uniform in appearance, and shall not foam when heated to 177 degrees C.

26.4 Installations

26.4.1 General: The location of the sewer line shall be as shown on the plans. Sewer pipe shall be fully encased in concrete, where such requirement is noted on the plans.

26.4.2 Pipe-Laying: The bottom of the trench shall be shaped to give uniform circumferential support to the lower fourth of the pipe. Each pipe shall be laid true to line and grade and in such manner as to form a close concentric joint with the adjoining pipe and to prevent sudden offsets in the flow line. Trenches shall be kept free from water until pipe jointing material has set, and pipe shall not be laid when the condition of the trench or the weather is unsuitable for such work. When work is not in progress, open ends of pipe and fittings shall be securely closed so that no trench water, earth, or other substances will enter the pipe or fittings. Pipe laying shall proceed up grade with the spigot end pointing in the direction of the flow.

26.4.3 Hot-Poured Bituminous Compound Joints: The gasket shall be rammed solidly and tightly home into the annular space within the socket of the pipe with a suitable caulking tool. A suitable runner shall be placed around the pipe to close the socket opening. The bituminous compound shall be heated to approximately 175 degrees C. (350 degrees F.). The compound shall be poured into the joint in such a manner that the annular space will be completely filled.

26.4.4 Lead Caulked Joints shall be made by the using of a packing material and hot caulking lead. The packing materials shall be handled with care in order to prevent contamination and shall be dry when put into place in the joint. The material shall be free of oil, tar or grease. Before jointing, all lumps, blisters, and excess coating material shall be removed. The outside of the spigot and the inside of the bell shall be wire-brushed and wiped clean and dry. The joint packing shall then be carefully placed and tightly caulked to a uniform thickness. No loose or frayed ends of fiber shall protrude into the space to be filled with lead. Each joint shall be carefully inspected and checked for proper depth before the lead is poured. The depth of lead in the joints shall be not less than 2 on back of the face of the bell. Lead shall be heated in a melting pot kept near the joint to be poured, brought to proper temperature, so that when stirred, the surface will

show a rapid change in color, and when poured into the joint space, will insure a perfect joint. Before lead is poured, scum shall be removed. Each joint shall be made with one pour completely filling the joint space. The caulking shall be done by competent mechanics, in such manner as to secure tight joints.

26.4.5 Septic Tank, Manholes, Distribution Box, Cesspool and Oil Interceptor
shall be constructed of materials, sizes and shapes as shown on the plans.

- End of Section -

SECTION 27 - AIR CONDITIONING

27.1 General Requirements: The work includes the providing of air conditioning, complete.

27.2 Materials and Equipment shall be the approved products of the manufacturers regularly engaged in the manufacture of such products. Items of equipment shall essentially duplicate equipment that has been in satisfactory use at least 2 years.

27.3 Applicable Specifications and Standards:

27.3.1 Federal Specifications:

F-F-300	Filter, Air Conditioning, (Viscous-impingement Type) Cleanable, Low Velocity.
BB-C-00310	Chlorofluoro Hydrocarbons (of the Methane and Ethane Series)
HH-I-542	Insulation Felt, Thermal, Mineral Wool (for Low Temperature)
HH-I-562	Insulation, Thermal, Mineral, Wool, Block or Board and Pipe Insulation (Molded Type)
CC-S-0077Sb	Steel Sheets, Carbon, Zinc-Coated
WW-P-406b	Pipe, Steel (Seamless and Welded) (for Ordinary Use)
WW-P-521d(1)	Pipe-Fitting, Malleable Iron, Wrought Iron and Steel, (Screwed), 150 pound.
WW-T-799a(1)	Tubing, Copper, Seamless (for Use with Solder-Joint or Flared-Tube Fittings)

27.3.2 Federal Standards:

No. 141 & change Notices 1, 2 & 3	Paint, Varnish, Lacquer and Related Materials, Methods of Inspection, Sampling and Testing.
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27.3.3 Air Conditioning and Refrigeration Institute Standards:

No. 210-64	Unitary Air Conditioning Equipment
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27.3.4 Underwriters Laboratories, Inc., Standard:

Building Materials List (January 1964 with Supplements)

27.4 General: The drawings indicate the extent and general arrangement of the air-conditioning system. Equipment and ductwork arrangements shall fit into space allotted and shall allow adequate acceptable clearances for installation, replacement, entry, servicing, and maintenance.

27.4.1 Capacities of all equipment and material shall be not less than those indicated.

27.4.2 Nameplates: Each major component of equipment shall have the manufacturer's name, address and catalog number of a plate securely attached to the item of equipment.

27.4.3 Prevention of Rust: Surfaces of ferrous metal shall be given a rust-inhibiting coating where specified. Where a rust-inhibiting coating is specified hereinafter, any treatment method that is approved by the Contracting Officer is acceptable unless a specific coating is specified. Coal tar- or asphalt-type coatings will not be acceptable, unless so stated for a specific item. Where steel is specified to be hot-dip galvanized mill-galvanized sheet steel may be used provided all raw edges are painted with a zinc-dust pigmented paint.

27.5 Materials shall conform to the respective specifications and other requirements specified below.

27.5.1 Duct Insulation: Federal Specification HH-1-542, type I or II, thickness as specified hereinafter.

27.5.2 Refrigerant: Federal Specification BB-C-00310.

27.5.3 Zinc-Coated Carbon Steel Sheets: Federal Specification QQ-S-00775b (NAVY-Ships)

27.5.4 Refrigerant Piping: Seamless Copper Tubing conforming to Federal Specification WW-T-799a(1), type K or L, annealed or hard drawn as required.

27.5.5 Drain Piping: Zinc-coated steel pipe conforming to Federal Specification VV-P-406b, weight A with zinc-coated malleable iron pipe fitting conforming to Federal Specification WW-P-521d(1), type II.

27.6 Air Conditioner:

27.6.1 General: Each air conditioner shall be a unitary type consisting of a completely self-contained unit as indicated. Each unit shall be provided complete with frame and enclosure, inter-connecting wiring, necessary controls and safety devices, operating charge of refrigerant and oil, and shall be ready for full-capacity operation after removal of shipping protection, and connection to utilities. Where units are shipped with refrigerant-holding charge, the system shall be completely charged in the field. Units shall be tested in accordance with Air-Conditioning and Refrigeration Institute Standard No. 210-64. Refrigerant shall be R-12 or R-22.

27.6.2 Compressor shall be semi-hermetic or hermetic type. Each compressor shall be provided with high-low-pressure safety cutoff with manual reset.

27.6.3 Cooling Coil: Fins and tubes shall be non-ferrous metal.

27.6.4 Air Handling Fans: One double-width, double-inlet, forward- or backward-curved blade, centrifugal-type fan shall be provided in each air-discharge opening in the fan section. Fan shall be V-belt driven by constant-speed motor and shall have an adjustable sheave to provide not less than 20 percent fan-speed adjustment. The sheave size shall be selected so that the fan speed at the approximate midpoint of the sheave adjustment will produce the specified air quantity. Fan motors shall have drip proof enclosure. Motor starters shall be magnetic across-the-line type with general-purpose enclosure installed in the unit.

27.6.5 Condenser shall be as specified hereinafter under paragraph: **Condensers.**

27.6.6 Filters shall be as specified hereinafter under paragraph: **Filters.**

27.6.7 Outer Casing shall be constructed of insulated heavy-gage metal panels adequately reinforced with angles of formed metal frame and provided with easily removable access panels located as required for access to all parts of the equipment. Casing shall be finished with rust preventive coating as described above. Fan and coil section of casing shall be insulated with 1" thick rigid insulation. Insulation to be coated to provide protection against the air stream.

27.6.8 Controls: Fan-off-cool switch shall be mounted adjacent to thermostat. Thermostat shall be mounted in the unit or remotely mounted where indicated. All other controls including motor starter and safety controls shall be mounted inside the enclosure, and all wiring thereof shall be accomplished at the factory. Motor starters for compressors shall be magnetic across-the-line type as specified. Motor starters for fans shall be magnetic across-the-line type. Enclosures for motor starters shall be general purpose classification mounted in control panel of unit.

27.7 Filters shall be located to filter return air opening inside of the air-conditioner casing. Filters shall be class 1 or 2 in accordance with the requirements of Underwriters' Laboratories, Inc., Building Materials list. Filters shall be 2 inches thick. Filters shall be cleanable type in accordance with Federal Specification F-F-300 of size required to suit the application. Viscous adhesive with flashpoint not less than 325 degrees F. shall be furnished in 5-gallon containers in sufficient quantity for twelve cleaning operations, and not less than 1 quart shall be provided for each filter section.

27.8 Condenser shall be air cooled type and shall be an integral part of the air-conditioning unit, fully enclosed within the unit housing.

27.8.1 Condenser Coil shall be an extended-surface fin-and-tube type constructed with copper tubes and aluminum or copper fins as specified. The coil shall be designed for use with the refrigerant employed in the air conditioner. Refrigerant-12 condensers shall be designed for working pressure of not less than 225 psi and factory tested at not less than 340 psi. Refrigerant-22

condensers shall be designed for working pressure of not less than 300 psi., and factory tested at not less than 400 psi.

27.8.2 Condenser Fans shall be either centrifugal or propeller type as best suited for the application. Fans shall be belt driven or direct connected to low-speed electric motors. Belt drive shall be provided with guard and adjustable sheaves to provide not less than 20 percent fan-speed adjustment. The sheaves shall be selected to provide the capacity indicated at the approximate midpoint of the adjustment.

27.8.3 Condenser Electric Motor shall be totally enclosed. Motor starter shall be magnetic across-the-line type with general purpose enclosure, mounted in control panel of unit.

27.9 Ductwork:

27.9.1 General: Ductwork shall be constructed of galvanized-steel sheets. Unless otherwise approved, ducts shall conform accurately to the dimensions indicated, and shall be straight and smooth on the inside, with joints neatly finished. Ducts shall be anchored securely to the building in an approved manner and shall be so installed as to be completely free from vibration under all conditions of operation. Curved elbows shall have a centerline radius not less than 1-1/2 times the width of the duct. Joints shall be made substantially airtight, and no dust marks from air leaks shall show at duct joints or connections to grilles and diffusers. Laps shall be made in the direction of air-flow. Edges and slips shall be hammered down to leave a smooth interior-duct finish. Button or bolt connections in standing seams shall be spaced at fixed centers not greater than 6-inch spacing. Transformations shall be made with a slope ratio of 4:1 minimum and 7:1 where practicable, or in a specifically approved manner. Ducts shall have cross brack of sufficient center height to assure rigidity in the duct section. The sheet-metal ducts and stiffeners shall conform to table 1.

Table 1

Sheet-metal thicknesses for rectangular-duct construction ¹

Galv. sheet gage	Maximum size (inches)	Type of transverse joint connections ²	Bracing
26	Up to 12	S, drive, pocket, or bar slips, on 7-ft. 10-in. centers.	None
24	13 to 24	S, drive, pocket, or bar slips, on 7-ft. 10-in. centers	None
	25 to 30	S, drive, 1-in. pocket or 1-in. bar slips, on 7-ft. 10-in. centers ³	1 x 1 x 1/8-in. angles 4-ft. joint.

¹ For normal pressures and velocities used in typical ventilating and air-conditioning systems. Where special rigidity or stiffness is required, ducts shall be constructed of metal two gages heavier. Cross bracing may be omitted on uninsulated ducts if metal two gages heavier is used.

² Other joint connections of equivalent mechanical strength and airtightness may be used.

³ Duct sections of 3-ft. 9-in. length may be used with bracing angles omitted, instead of 7-ft. 10-in. lengths with joints indicated.

27.9.2 Splitters and Dampers: Splitter dampers and manual volume-control dampers shall be operated by locking-type quadrant operators. Dampers and splitters shall be 2 gages heavier than duct in which installed.

27.9.3 Air Deflectors shall be provided in all square elbows, duct-mounted supply outlets, and top-in branch-takeoff connections. Air deflectors shall be factory fabricated and assembled.

27.9.4 Apparatus Connections: At points where sheet-metal connections are made to fans or where ducts of dissimilar metals are connected, a flexible connection of 15-ounce woven asbestos, or other approved non-combustible

material, approximately 6 inches in width shall be installed and securely fastened by zinc-coated iron clinch-type bands.

27.9.5 Duct Supports shall consist of not less than 1 inch by 1/16-inch galvanized strap-iron hangers spaced not over 4 feet on centers, or as shown.

27.10 Diffuser, Registers and Grille:

27.10.1 General: Diffusers, registers and grilles shall be factory-fabricated steel or aluminum and shall distribute the quantity of air specified evenly over space intended without causing noticeable drafts over 50 fpm. in occupied zone, or dead spots anywhere in the conditioned area. The contractor shall be responsible for diffusion, spread, drop, and throw. If, according to the certified data of the manufacturer of the proposed units, the sizes indicated will not perform satisfactorily, the units shall be reselected to perform quietly and effectively in accordance with the manufacturer's recommendations and as approved. Diffuser and registers shall be provided with volume control and accessible operator. After the system is in operation, if excessive noise, drafts, or dead spots, are noticeable in the conditioned spaces due to improper selection of type and size of diffuser, register or grille, the unit shall be changed to the proper size and type without additional cost to the Government.

27.10.2 Diffuser shall be square, or rectangular as indicated, and shall be of the fixed pattern. Units shall extend to a minimum below the ceiling.

27.10.3 Registers shall be four-way directional-control type except that return registers shall be fixed pattern of design similar to supply-register face. Each registers shall be provided with a face-operated opposed-blade volume-control damper. Free area of all registers shall be not less than 70 percent of face area.

27.10.4 Grilles shall be as specified herein for registers, without volume-control feature.

27.11 Duct Insulations:

27.11.1 General: Duct shall be insulated to the thicknesses as hereinafter specified with mineral wool. A vapor-barrier facing material consisting of 0.002-inch thick aluminum foil reinforced with kraft paper and glass fibers or other approved vapor-barrier material, shall be applied to the exterior of all

duct insulation. Vapor barrier shall be noncombustible. Insulation shall be secured to rectangular ducts by welded pins or metal stick clips and speed washers spaced not over 12 inches on centers each way. Where insulation joints occur, facing tabs shall be over-lapped not less than 2 inches and sealed with an approved noncombustible adhesive recommended by manufacturer of the facing material. All punctures in the facing material shall be sealed.

27.11.2 Thickness of Material:

27.11.2.1 Return-Air Ducts, and Air-Conditioning Supply Ducts: One inch-thick material.

27.11.2.2 Insulated Ducts Exposed to Weather: Two-inch thick material. Insulation finish shall be 0.016-inch thick corrugated aluminum sheet with joints lapped not less than 3 inches, sealed and secured with No. 6 by 3/8-inch aluminum sheet-metal screws, or aluminum hand-gun-rivets. Finished with one layer of roofing felt, 15 lb. density, mopped to provide watertight enclosure.

27.12 Equipment Installation: Necessary supports shall be provided for the air conditioners as shown.

27.13 Cleaning, Testing, and Balancing:

27.13.1 Cleaning and Adjusting: Ducts shall be thoroughly cleaned of all debris and blown free of all small particles of rubbish and dust before installing outlet faces. Equipment shall be wiped clean, with all traces of oil, dust, dirt, or paint spots removed. Temporary filters shall be provided for all fans that are operated during construction, and after all construction dirt has been removed from the building, new filters shall be installed. Bearings shall be properly lubricated with oil or grease as recommended by the manufacturer. Belts shall be tightened to proper tension. All control valves and other miscellaneous equipment requiring adjustment shall be adjusted to setting indicated or directed. Fans shall be adjusted to the speed indicated by the manufacturer to meet specified conditions.

27.13.2 Testing:

27.13.2.1 Ductwork: Ducts, plenums, and casings shall be tested and made substantially airtight before covering with insulation or concealing in masonry. Substantially airtight shall be construed to mean that no air leakage is noticeable through the senses of feeling or hearing.

27.13.3 Balancing:

27.13.3.1 Duct Systems shall be balanced to produce air quantities within 5 percent of that indicated.

27.13.4 Performance Tests: After cleaning, balancing, and testing operations have been completed, as heretofore specified, the system shall be tested as a whole to see that all items perform as an integral part of the system, and that temperatures and conditions are evenly controlled. Corrections and adjustments shall be made as necessary to produce the conditions indicated.

27.14 Painting and Finishing:

27.14.1 Factory Prime Coats: The following items shall be cleaned and painted at the factory with type A finish without the finish coat. Surfaces with rust-inhibitor treatment shall not be blasted.

Air-conditioner casing inside and outside
Diffuser
Fan inside and outside
Registers and Grilles

27.14.2 Field Painting: All ferrous metal not specified to be painted at the factory shall be primed and painted in accordance with SECTION: FIELD PAINTING.

27.15 Operating and Maintenance Instructions: Operating and maintenance instructions complete for each air conditioner shall be furnished by the contractor.

27.16 Spare Parts Kit: A spare parts kit consisting of the following items shall be delivered to the Contracting Officer:

1. Fan Motors: Two required, one for each size AC unit.

2. Belts: Belts for a complete belt replacement for each of three units. If belts are multiple matched sets, the set shall be segregated and identified as a matched set.
3. Bearings: One replacement for each fan bearing in each of three units.
4. Condenser Fan and Motor: One for each size required.

In addition to the spare parts listed above, a complete list of parts and sub-assemblies with the manufacturers identifying part number and price list shall be furnished, and the address of a recommended source of supply both in Thailand and the United States.

27.17 Maintenance Service Contract: The Contractor shall include in his work all material and labor required for routine maintenance for a period of 12 months, beginning on the date of beneficial occupancy. Maintenance records shall be kept and delivered at the end of this period of time. Maintenance Record shall indicate the following items completed once each month:

- (a) Filters changed;
- (b) RPM of Fan,
- (c) Belts inspected,
- (d) Voltage fan motor,
- (e) Amperage fan motor,
- (f) Voltage of compressor motor(s),
- (g) Amperage of compressor motor(s),
- (h) Voltage condenser fan motor(s),
- (i) Amperage of compressor motor(s),
- (j) Leak test refrigeration piping circuits,
indicate any leak and refrigeration added,
- (k) Sight glass clear,
- (l) Suction and discharge pressure of all compressors,
- (m) Space conditions in transmitter room and office. Drybulb and wet bulb temperatures, and
- (n) Outside ambient temperatures: drybulb and wetbulb.

The records shall indicate any remedial action accomplished during routine maintenance, and shall also indicate any repair required to maintain the equipment in proper operating condition.

27.17.1 Truck Crane shall be installed on the roof of Transmitter Building as shown. Crane shall be full revolving and socket mounted. Pillar shall be of heavy wall seamless steel pipe with a large diameter eye for hoist attachment. Boom shall rotate 360 degrees. Bottom socket assembly shall be suitable for wall mounting. Entire crane assembly shall be galvanized.

27.18 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the Contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer. In addition, the Contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performance satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

- End of Section -

SECTION 28 - ELECTRICAL WORK: INTERIOR

28.1 General Requirements: The work includes the providing of generator installation and interior electrical lighting and power systems, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

28.1.1 Nameplates: Nameplates shall be furnished for all major component parts of equipment, identifying the equipment with respect to service, capacity and required operating instructions. The identification plates shall be of appropriate material with bold type letters of appropriate size for easy reading. All nameplates shall be fastened to the equipment with sheet metal screws.

28.2 Applicable Specifications and Standards:

28.2.1 Federal Specifications:

J-C-129c(2)	Cable and Wire: Thermoplastic-Insulated General Purpose (0 - to 600-Volt Service)
W-8-30(2)	Ballast, Fluorescent Lamp
W-F-414a	Fixture, Lighting (Fluorescent, Alternating Current, General Purpose).
W-L-116a(3)	Lamps, Fluorescent
HH-I-510a	Insulation Tape, Electrical, Friction
HH-I-553	Insulation Tape, Electrical, (Rubber, Natural & Synthetic)
WW-C-581d(3)	Conduit, Metal, Rigid, and Coupling, Elbow, and Nipple Electrical Conduit, Zinc-Coated

28.2.2 National Electric Manufacturer's Association (copies of publication are obtainable from Edison Electric Institute, 750 Third Avenue, New York 17, N.Y.)

AB1-1939	Molded case circuit breaker
IC1-1939	Industrial Control

28.2.3 NFPA: (National Fire Protection Association, 85 Johns Street, New York 38, New York)

Pamphlet
Number

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National Electrical Codes 1965

28.3 Code Requirements: The complete installation shall comply with applicable provisions of the National Electric Code 1965 Edition except as otherwise shown or specified herein.

28.4 Departures: The drawings indicate the extent and general arrangements of the wiring and raceway systems. If any departure from the contract drawing is deemed necessary by the Contractor, details of such departure, and the reasons therefore, shall be submitted to the Contracting Officer for approval. No such departures shall be made without prior written approval.

28.5 Standard Products: Materials furnished under this specification shall be standard products of manufacturers regularly engaged in the production of such equipment and shall be the manufacturer's latest standard design.

28.6 Materials and Equipment Schedules: As soon as practicable and within 30 days after the date of award of contract and before any material or equipment is purchased, the Contractor shall submit for approval a complete list, in triplicate, of materials, fixtures, and equipment to be incorporated in the work. The list shall include catalog numbers, cuts, diagrams, drawings, and such other descriptive data as may be required. No consideration will be given to partial lists submitted from time to time. Approval of materials will be based on manufacturers' published ratings. Any material, fixtures, and equipment listed which are not in accordance with the specification requirements may be rejected.

28.7 Grounding: Raceway systems and neutral conductor of the wiring system shall be grounded, and the ground connections shall be made at the Service Switchboard. All metallic fixtures, fittings and equipment shall be grounded. A bare conductor of proper size shall be provided wherever grounding continuity is lost due to the use of flexible conduit. Install the conductor in the conduit and terminate properly at both ends. All metallic non-current carrying portions of the electrical system shall be grounded. Cords and UF cables shall have a separate grounding conductor.

28.8 Wiring and Raceways Conductor for circuits of 480 volts between conductors, or less, shall have insulation rated not less than 600 volts. Conductors for higher voltages and busways, shall be rated as indicated."

28.8.1 Telephone wiring and cables shall be Government furnished and installed. Contractor shall install and provide conduits, pull wire, outlets and cabinets.

28.8.2 Telephone Raceways. As indicated shall be installed in accordance with preceding requirements for conduit but with the additional requirements that no run shall exceed 75 feet for 3/4-inch sizes and 150 feet in length for 1-inch or larger sizes, and shall not contain more than three 90-degree bend or equivalent. Additional pull or junction boxes shall be installed to comply with these limitations whether or not indicated on the drawings. Inside radii of bends in conduits of 1-inch size or larger shall be not less than ten times the trade diameter. A zinc-coated steel wire not less than 12 gage shall be installed in empty telephone conduits with not less than 8-inches of slack left at each outlet.

28.8.3 Wiring in Conduit or EMT shall be single conductor with Type TW insulation up through No. 8 Wires, No. 6 and larger shall be SHW, THW or THWN. Conductors in raceways, and cables shall be of copper, rubber or thermoplastic insulated. Conductors in wet locations shall be installed in rigid steel conduit. Thermoplastic-insulated conductors shall conform to Federal Specification J-C-129e(2).

28.8.4 Conduit and Tubing Systems (Raceways) Conduit shall be rigid zinc-coated steel. Conduit shall not be plastic. Conduit shall be installed in accordance with Article 346 of the National Electrical Code. Minimum size of conduit and tubing shall be 1/2-inch. Raceways shall be concealed within finished walls, ceilings, and floors where possible unless indicated otherwise. Raceways shall be rigidly supported at intervals of not more than 8 feet and shall have runs installed parallel or perpendicular to walls, structural members, or intersections of vertical planes and ceilings. Field made bends and off-sets shall be avoided where possible, but where necessary shall be made with an approved hickey or conduit bending machine. Changes in directions of runs shall be made with symmetrical bends or cast-metal fittings conforming to Federal Specification W-C-386a. In dry locations, fittings may be of aluminum or of zinc- or cadmium-coated steel. Crushed or deformed raceways shall not be installed. Trapped raceways shall be avoided where possible. Care shall be taken to prevent the lodgment of plaster, dirt, water or trash in raceways boxes, fittings, and equipment during the course of construction. Only approved puttying-in compounds shall be used in raceways. Raceways shall be entirely free of obstructions or shall be

replaced. Conduits shall be fastened to all sheet metal boxes and cabinets with two locknuts. Bushings shall be installed on the ends of all conduits and shall be of the insulating type. All conduit which is imbedded in concrete or masonry, or is exposed less than 1.6 meters above the floor or below grade, shall be rigid galvanized. Conduit below grade shall have threads coated with white lead, and all scratches or tool marks shall be painted with zinc paint.

28.8.4.1 Steel Conduit shall conform to Federal Specification WW-C-581d(3).

28.8.4.2 Electrical Metallic Tubing shall be zinc-coated and shall conform to Federal Specifications WW-T-600 and shall be installed in accordance with Article 348 of the National Electrical Code. EMT of one-inch size and smaller only shall be used.

28.8.5 Branch-Circuit Conductors shall be not smaller than No. 12 AWG. Conductors shall be continuous from outlet to outlet, and no splices shall be made except within outlet or junction boxes.

28.8.6 Junction Boxes shall be utilized where required.

28.8.7 Splices: Wire connectors of insulating material or solder-less pressure connectors, properly taped, shall be utilized for all splices in wiring. Rubber and friction tape shall conform to the requirements of U.S. Federal Specifications HH-1-533 and HH-1-510s respectively. Vinyl plastic tape will be acceptable in lieu of rubber and friction tape.

Untaped pre-insulated compression connectors, applied with proper tools, may be used for splices. Not more than four conductors shall be connected in one splice. Each splice for fixture connections shall be made to a single conductor, using spiral wire connectors (wire nuts) with insulating covering.

28.9 Outlets shall conform to the following requirements with respect to locations. (minimum box size shall be four-inches square or octagonal):

- (a) Sheet Steel Boxes, zinc-coated or cadmium-coated, conforming to Federal Specification W-J-800s type suitable for the use intended, shall be used for concealed work, and shall be of a minimum size of four inches.

- (b) Cast Metal Boxes, galvanized malleable iron or aluminum, conforming to Federal Specification W-C-586a, Class 1, shall be used in combination with exposed metallic conduit.
- (c) Pressed Steel Boxes, one piece, cadmium plated, shall be used in combination with EMT.
- (d) Fixture Boxes, of approved type not less than 4 inches wide, and 1 1/2" deep, shall be used on ceilings.
- (e) Gang Boxes, one piece, cadmium plated steel, shall be used where necessary.
- (f) Combination Boxes, switch and receptacle, shall be not less than 4 inch (10.2 cm) square, and shall be used where necessary.
- (g) Clock outlets shall be the recessed - receptacle type with mechanical support on the cover-plate for surface-mounted clock.
- (h) Telephone outlets and cabinets. Telephone terminal cabinets shall be of steel and shall conform to the National Electrical Code, and shall be sized as shown. The boxes or cabinets shall be made from steel sheets zinc-coated by the hot-dip process. The fronts of cabinets shall be finished to resist corrosion with not less than one priming coat and one pearl-gray finishing coat. Wall outlets shall be standard rectangular switch boxes approximately 4 by 4 inches by not less than 1-1/2 inches deep with one-hole cover plates of fire resistant non-absorptive hot-molded composition.

28.9.1 Installation: Boxes shall be installed in a rigid and satisfactory manner using wood screws on wood and expansion shields on masonry.

28.10 Weatherproof Convenience Outlets shall be installed where indicated, and shall consist of a single convenience outlet in a flush box with a gasketed, weather-proof, cadmium-plated, metal cover plate having a spring-binged, lift-up gasketed lid.

28.11 Device Plate shall be provided for each outlet to suit the device installed. All plates on unfinished walls or on fittings shall be of zinc-coated sheet metal

having rounded or beveled edges. All plates on finished walls shall be of brown phenolic compound plates having polished stippled or polished ribbed finish with plain polished borders. Screws shall be of metal with countersunk heads, with finish to match the finish of the plate. Plates shall be installed with all four edge in continuous contact with finished wall surfaces without the use of mats or similar devices. Plaster fillings will not be permitted. Plates shall be installed vertically and with an alignment tolerance of 1/64 in. (0.5 mm) in 6-inch (15.2 cm). Device plates shall be of the one-piece type, of suitable shape for the devices to be covered. The use of sectional device plates will not be permitted.

28.12 Pull Boxes shall be constructed of code gage galvanized sheet metal, of not less than the minimum size recommended by the National Electrical Code. Boxes shall be furnished with screw-fastened covers. Where several feeders pass through a common pull box, they shall be tagged to indicate clearly their electrical characteristics, circuit number, and circuit designation.

28.13 Wall Receptacles shall conform to Federal Specification W-C-596a type and style as herein specified. Heavy-duty receptacles shall be of the single type having capacity to carry the rated load continuously without damage and shall be furnished with a suitable cord-grip cap.

28.13.1 Duplex Convenience Receptacles for general service shall be specification grade grounding type rated 15 amps 125 volts 2 pole 3 wire, in accordance with Federal Specification W-C-596. Receptacles shall have bodies of brown colored molded material, back or side wired with two screw terminals per pole and two grounding terminals. Receptacles shall be of a type making contact on both sides of an inserted blade, and shall have mounting yokes with plaster ears.

28.14 Wall Switches for general service on a-c circuits shall be of the totally-enclosed, tumbler, quiet a-c, heavy-duty type rated 15 amps 120-277 volts, and shall conform to the requirements of Federal Specification W-S-896c(c) or W-S-893c. Switches shall be back or side wired type with screw terminals. Handles shall be of brown colored molded material. Switches shall be single or two-pole, 3-way, or 4-way as required.

28.15 Lamp and Lighting Fixtures of types and sizes as indicated on the drawings shall be furnished and installed complete.

28.15.1 Lamps of the proper type, wattage, and voltage rating shall be furnished and installed in each fixture.

28.15.1.1 Incandescent lamps shall conform to Federal Specification W-L-101f(2) and the latest supplement. They shall be for 120-volt operation unless otherwise specified.

28.15.1.2 Fluorescent lamps shall be the rapid or trigger start type conforming to Federal Specification W-L-116a(2) and shall have standard cool white color characteristics. Standard 40 watt 48 inch lamps shall have an initial light output of not less than 3000 lumens.

28.15.1.3 Mercury-Vapor Lamps shall be suitable, and of proper bulb shape, for the fixtures with which they are to be used. Unless otherwise indicated, mercury-vapor lamps shall be phosphor-coated, color improved type, and shall have a rated life of not less than 16,000 hours.

28.15.2 Fixtures shall conform to the Underwriters' Laboratories, Inc. standard for Electric Lighting Fixtures. Fluorescent lamp ballasts shall be the high power factor, rapid or trigger start type, suitable for the lamps used and shall conform to Federal Specification W-B-30(2). Ballasts shall have nontresetting thermal protectors.

"Mercury-vapor lamp ballasts shall be of the regulated-output high-power-factor type".

28.15.2.1 Illustrations shown on the drawings shall be indicative of the general type desired and shall not restrict selection to fixtures of any particular manufacturer. Fixtures of similar designs and equivalent light-distribution and brightness characteristics having equal finish and quality will be acceptable if approved by the Contracting Officer.

28.16 Floodlights shall be of the enclosed type, mercury vapor and of wattage as indicated suitable for operation on 120 volts, 60 cycles as indicated. Beam spread shall be as indicated. Support shall be adjustable with provision for locking in the required position. Floodlights shall be grounded. Ferrous metal parts shall be zinc-coated and aluminum parts shall be anodized except for weather proof enclosed reflectors.

28.17 Panelboards shall be of the dead-front safety conforming to the Underwriters' Laboratories Inc., standard for Panelboards, and provided with the size and number of circuits as indicated on drawings. Mains shall be arranged for a grounded, solid neutral system. Boxes shall be of steel having a zinc-coated and enameled finish. Panel-boards shall be the automatic circuit breaker type, and shall conform to W-P-115a. Circuit breakers shall conform to W-C-375a.

28.18 Transformers shall conform to specification W-T-631a, to the National Electrical Manufacturers Association, Standards for Transformers, Publications nos. T81 and ST1, and to the American Standards Association, American Standards for Transformers, Regulators, and Reactors, Publications nos. C57 and C89.1.

28.19 Motors and motor control equipment:

28.19.1 Motors shall conform to specification CC-M-00636b and CC-M-641b for fractional and integral horsepower motors respectively. Motors not covered by the foregoing specifications shall conform to the American Standards Association Standards Publication: Rotating Machinery, Publication No. C50. Alternating-current motors shall be wound for a frequency of 60 cycles per second.

28.19.2 Motor Controllers: Starters for a-c induction motors shall conform to specification MIL-S-12514, and to the requirements of the National Electrical Manufacturers Association Publication ICI entitled "Standards for Industrial Control". Starters shall be manual or magnetic, across-line or reduced voltage, or combination type as indicated. Starters shall provide thermal overload protection for the motor by means of heaters and overload devices, or by thermostatic elements embedded in the motor windings. Overcurrent protection shall be provided for all three phases of 3-phase motors. Heater elements for starter overload devices shall be selected and furnished based on the nameplate current rating of the motor. In addition, for starters with non-adjustable over-current devices, one set of space heaters having a rating approximately 20% greater than the heaters installed in the starter shall be furnished with each starter. Magnetic starter coils and control relays shall be rated for 60-cycle service. Starter enclosures shall be of the type indicated and shall be suitable for the location where installed.

28.19.2.1 Starter Control Devices shall be provided as indicated. If not otherwise specified, magnetic starters intended for manual control shall be provided with cover-mounted start-stop push buttons wired to provide under-voltage protection. Starters controlled from interlock circuits or on-off control devices such as pressure switches and float switches shall be provided with a cover-mounted on-off-automatic switch. Starters, including manual starters, controlling motors or devices not visible from the controller locations or otherwise arranged such that it is not readily apparent from the controller location whether or not the motor is running or the device energized, shall have a cover-mounted red pilot light wired to be lighted when the controller is closed. At contractor's option, devices required by this paragraph may be mounted in a separate enclosure of the same type as the associated starter or controller, located with the starter in lieu of being cover-mounted as specified.

28.19.2.2 Combination Starters shall be the circuit-breaker type. The operating handle of the disconnect device in combination starters shall be provided with a means for padlocking in the "off" position, and shall be interlocked with the door or cover of the starter to prevent opening the door or cover unless the switch or circuit breaker is in the off position.

28.20 Fungus Control for Electric Components: The equipment shall be treated to resist fungus and moisture as specified below.

28.20.1 Materials and Components which are inherently fungus resistant or are protected by hermetic sealing need not be treated.

28.20.2 Circuit elements, not covered above and which have a temperature rise of not more than 75 degrees F when operating at full load, shall be coated with a fungus-resistant varnish conforming to Military Specification MIL-V-1738(1), type I or type II at the contractor's option. The method of treatment shall be in accordance with Military Specification MIL-T-1528. Circuit elements include cable and wire.

28.21 Marking: Enclosures of electrical equipment, starters, control stations and similar locations as directed, shall be provided with a suitable nameplate or stencilled legend identifying the equipment or function served. The color-coding and marking requirements of the National Electrical Code shall be adhered to. Control circuit wiring shall be color-coded in accordance with the recommendations of the IPCEA. Where more than three control-circuit conductors occupy one conduit or wireway, each shall be identified with suitable label of an oil resistant material indicating the wire number, or terminal number to which connected. Each wire shall have the same identification at both ends, and no two wires shall have the same identification. Where applicable, wire identification shall be indicated on the appropriate wiring or control diagrams. Wiring and raceways extending outside the building, or for future use, or whose function is not otherwise readily apparent, shall be tagged or marked at both ends with a suitable permanent-type identification means.

28.22 Manuals: All installation-instruction leaflets, parts lists, operating-instruction sheets, wiring diagrams and similar literature packed with equipment or otherwise obtained by contractor for all equipment and devices installed in the facility, shall be assembled by the contractor, bound neatly in a substantial folder or cover, and submitted to the Contracting Officer prior to performing the acceptance tests for the completed facility. Each brochure or leaflet shall be marked to indicate the building, contract number, and location where installed. In addition, for installations requiring field-installed control connections between a number of devices (except conventional on-off switches or single start-stop push button stations) contractor shall prepare or cause to be prepared an interconnecting wiring diagram or diagrams indicating equipment terminals, terminal and wire numbers, and wire coding and routing as installed. Where control schemes involving a coordinated sequence of functions by an operator for start-up, shut-down or maintenance, are installed, contractor shall furnish a scheme of operations and coordinated operating instructions. These instructions should be prepared by the manufacturer of the major equipment or control item. When so directed, contractor shall provide one copy of these instructions, in English and the local language, framed under glass and mounted as directed. One copy of these instructions and all related wiring diagrams, shop drawings, and interconnecting diagrams, shall be bound with instruction leaflets etc. as specified in the foregoing.

28.23 Wire and Cable Color Code shall be used to identify the different phases as follows:

<u>Phase</u>	<u>120/208V & 240V</u>
A	Black
B	Red
C	Blue
N	White
G	Green

On wire sizes #8 and larger, a 1" wide colored tape band shall be applied to each conductor in lieu of colored insulation. The tape band shall be used to identify the conductors in panels, outlets, junction boxes and switchboards. Apply one band at the conduit entrance and one band at the cable terminal.

28.24 Tests: After the interior wiring system installation is completed, the Contractor shall conduct an operating test for approval. The equipment shall be demonstrated to operate in accordance with the requirements of this specification. The test shall be performed in the presence of the Contracting Officer or his authorized representative. The Contractor shall furnish all instruments and personnel required for the tests, and the Government will furnish the necessary electric power.

28.25 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. In addition, the contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performing satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

28.26 Material Procurement: Electric panelboards, cable tray and lighting fixtures shall be the standard product of a United States manufacturer regularly engaged in the production of the material.

- End of Section -

SECTION 29 FUEL TANKS AND PIPING

29.1 General: The contract drawings indicate the extent and general arrangement of the fuel tanks and piping systems. If any departures are deemed necessary details of such departures and the reasons therefor shall be submitted as soon as practicable for approval. No such departures shall be made without prior written approval. The dimensions of the equipment space are as indicated. Equipment and piping arrangement shall provide adequate and acceptable clearances for entry, servicing and maintenance.

29.1.1 Standard Products: The material and equipment to be furnished under this specification shall be the standard product of a reputable manufacturer. Where two or more units of the same class of equipment are required, these units shall be products of a single manufacturer; however, component parts of the system need not be the products of the same manufacturer.

29.1.2 Materials and Equipment Schedule: Before purchase of any materials or equipment, a plan and elevations of the equipment spaces showing the proposed piping and equipment together with a complete schedule of the material proposed for installation shall be submitted for approval. The schedule shall include catalogues, performance data, cuts, diagrams, drawings and such other descriptive data as may be required. In the event any items of material contained in the schedule or the plan and elevations of the equipment spaces, fail to comply with the specification requirements, such items or layout arrangement may be rejected.

29.2 Materials and Equipment: The following materials and equipment shall conform to the respective specification and other requirements specified below:

29.2.1 Steel Pipes: Federal Specification WW-P-406b, type 1, class A, coating as hereinafter specified.

29.2.2 Pipe Fittings: Federal Specifications WW-P-521d(1), class as required to match adjacent piping.

29.2.3 Unions: Federal Specifications WW-U-531a, class as required to match adjacent piping.

29.2.4 Steel Plates and Shapes: Federal Specification QQ-S-741a(1).

29.2.5 Steel Sheets: Federal Specification QQ-S-633a, composition, condition and finish best suited to the end use.

29.2.6 Lead Expansion Sleeves: Federal Specification FF-H-136(1), type 4425, of required sizes.

29.2.7 Wood Screws: Federal Specifications FF-S-111b, round head galvanized or brass and required size.

29.3 Piping and Fittings: Oil fill, oil supply & return, and sounding pipe shall be standard weight black steel pipe with 150 psi malleable iron fittings. Vent pipe shall be standard weight galvanized steel pipe with galvanized malleable iron fittings.

29.4 Fuel Oil Storage Tanks shall have capacities as indicated. The tanks shall be constructed and installed in accordance with Pamphlet No. 31 of the NFPU except as otherwise indicated, and shall be approved and labeled by the Underwriters' Laboratories, Inc. The tanks shall be provided with all pipe connections, including oil-fill, suction, return, vent, sounding and oil-burner connections. Tank gage rods calibrated to indicated gallons of oil content for each inch of depth shall be furnished. The rod shall be of a suitable hardwood or brass. The tank shall be supported on a concrete base and anchored by steel rods with adjustable devices. Tank shell shall be not less than 3/16-inch (6 mm.) thick.

29.5 Cleaning and Painting of Tanks: The exterior surfaces shall be prepared for painting by steel-grit or sand blasting. Prior removal of oil, grease and other foreign matter by solvents or mechanical means will not be required, provided that blast cleaning alone accomplishes the complete removal of mill scale, rust, oil grease, welding slag and other surface contaminants and leaves a surface of uniform appearance. Tanks shall be painted in accordance with Section: Field Painting.

29.6 Accessories: Tanks shall be fitted with two manholes not less than 500 millimeters in diameter. Manholes shall have a bolted cover and gasket. All tanks shall be provided with fill, suction and return pipes, vent pipe connection, screened gooseneck or tee vent, and gage stick. Fill pipes shall extend to within 5-inches (12.7 cm.) of the the bottom of the tanks and to not less than 6-inches (15 cm.) above the tanks. Fill and sounding caps shall be watertight, and fill cap shall be fitted with removable strainer. Suction pipe shall extend to within 3-inches (7.6 cm.) of the bottom of the tank. Pipe connections shall be as indicated on the drawings or as required by project specifications. Pipe connections shall be temporarily plugged before shipment.

29.7 Tests: Upon completion of the installation, the tanks shall be pressure tested at twice the working pressure of the system. Minimum pressure shall be 5 psi by hydrostatic test. All leaks shall be made tight.

29.8 Substitutions: If any substitutions of materials or equipment specified and/or shown are deemed necessary by the Contractor, comparative details of such substitution shall be submitted as soon as practicable, and within 30 days after award of the contract, to the Contracting Officer for approval. In addition, the Contractor shall furnish proof, satisfactory to the Contracting Officer, that items identical to those proposed as substitutions are in current use and performing satisfactorily in similar installations. No such substitutions shall be made without the prior and specific written approval of the Contracting Officer.

- End of Section -

SECTION 30 - FENCING: CHAIN-LINK AND BARBED WIRE

30.1 General Requirements: The work includes the providing of chain-link fences and gates, as shown.

30.2 Applicable Specifications and Standards:

30.2.1 Federal Specifications:

RR-F-191a Fencing: chain-link fabric

30.3 Materials:

30.3.1 Posts (Gate): Unless otherwise shown, shall be of hot-dip galvanized standard weight steel pipe having sizes as shown. When top rail is to be provided, posts shall be provided with clamp for fastening the top rail.

30.3.2 Posts (Corner, End and Pull) shall be of reinforced concrete of size and shape as shown. Post shall be provided with a hole suitable for the through passage of the top rail. Arm supports for barbed wire shall be of reinforced concrete, constructed integral with the posts at an angle of 45 degrees, shaped and size as shown. Arms shall be fitted with clips or other suitable means of attaching four lines of barbed wire, with the top outside wire approximately 12 inches horizontally from the fabric and other wires spaced uniformly between the top of the fence fabric and the outside barbed wire.

30.3.3 Post Braces: Unless otherwise shown, shall be of hot-dip galvanized standard weight steel pipe having sizes as shown, and a rod not less than 3/8 inch in diameter with turnbuckle provision for adjustment.

30.3.4 Gate Post Tops, unless otherwise shown, shall consist of plain galvanized standard pipe caps. The post tops shall fit snugly and attached securely on the posts.

30.3.5 Top Rails, unless otherwise shown, shall be hot-dipped galvanized standard weight steel pipe in lengths as long as practicable and shall be fitted with expansion couplings for connecting the lengths into a continuous run. The couplings shall be not less than 6 inches long. Means shall be provided for attaching the top rail securely to each gate, corner, pull and end post.

30.3.6 Stretcher Bars shall be of galvanized steel not less than 3/16 by 3/4 inch in cross section (or equivalent cross sectional area), and shall be of lengths equal to the full height of the fabric with which they are to be used. The stretcher bars shall be arranged for attaching to the fabric by threading through the fabric, by clamps, or other means.

30.3.7 Clips or Tie Wire shall be of adequate strength, and shall be provided in sufficient number for attaching the fabric and stretcher bars to all posts at intervals not exceeding 15 inches.

30.3.8 Reinforcing Wire, at top or bottom as shown, shall be coiled spring wire not less than 0.177 inch in diameter or shall be soft carbon steel hot dipped galvanized wire not smaller than No. 7 gauge.

30.3.9 Barbed Wire shall consist of two strands of hot dipped galvanized No. 12 1/2 gauge wire with 2-point No. 14 gauge barbs spaced not more than 5 inches apart.

30.3.10 Chain-Link Fabric shall conform to the requirements of Federal Specification RR-F-191a, Type A. Fabric shall be woven diamond mesh of 5 cm. dimension, of wire having a minimum diameter of 3.4 mm. Fabric height shall be as shown. Top and bottom edges shall have a twisted and barbed finish.

30.3.11 Hardware:

30.3.11.1 Bolts, Nuts, Washers and Turnbuckles shall be zinc-coated and of size and type suitable for the use intended.

30.3.11.2 Hinges shall be fabricated of galvanized, malleable iron, and shall be of size and weight suitable for the use intended. Hinges shall be clamped to the gate posts with 2- 3/8-inch diameter bolts as shown.

30.3.11.4 Locking Device for gates, unless otherwise shown, shall be the plunger rod type with lock keeper and guide for padlock, and shall be welded to gate member, as shown.

30.3.11.5 Padlock, corrosion resisting, shall be provided for each gate, not less than 2 inches in size, and provided with attached chain and with two keys.

30.4. Installation:

30.4.1 Post Holes shall be to depth shown, and shall be accurately centered along the line of the fence.

30.4.2 Setting of Posts: Post shall be set to proper elevation along the line of the fence and in the center of the excavation or of the concrete footing. Concrete shall develop a strength not less than 140 kg/cm^2 at 28 days, and shall conform to the applicable provisions of the section entitled Concrete Work. The posts shall be braced in a true and plumb position until the concrete has been poured and allowed to harden.

30.4.3 Top Rails shall not be installed until the concrete footing around the posts is sufficiently cured.

30.4.4. Chain-Link Fabric shall be stretched taut. Sufficient stress shall be applied to the fabric to take up all slack and present a smooth uniform surface along the line of the fence. Tension on each side of posts shall be equal. Distortion of the fabric by over-stretching shall be avoided. Unless otherwise shown, fabric shall be secured to posts and top rail with suitable clips or wire ties at not more than 40 cm. on centers on the top rail and not more than 30 cm. on center on posts. Lengths of fabric shall be carefully connected, and the extra lengths shall be salvaged to conform to the fabric.

30.4.5 Barbed Wire shall be installed in locations, as shown, and shall be stretched taut. Fastenings shall prevent wire from growing slack.

30.4.6 Braces, unless otherwise shown, shall be placed horizontally at mid-height of the fabric and shall extend from end, corner and gate posts to the first adjoining line post; rod, with turnbuckle for adjustment, shall extend back to the end, corner or gate post, and shall be placed diagonally in tension.

30.4.7 Gates shall be hung and properly adjusted after fencing is erected. The gates shall be adjusted to hang level and true to the fence. Chain-link fabric shall be used for gate filler. All hardware shall be secured, properly adjusted and left in perfect working order.

30.4.8 Grounding: Fence shall be grounded on each side of every gate and every 500 feet (152 meters) along the fence line by means of 3/4 inch (19 mm) by 10 feet (3.05 meters) copper or copper-clad steel ground rods, No. 8A.W.G. bare copper wire and clamps specially designed for electrical substation grounding.

30.5 Barbed Wire Fence: The finished fence shall conform to the alignment and finish grade indicated, with posts set plumb and wire stretched taut. Barbed wire shall pass thru the notches provided in the posts. Each strand shall be pulled taut and secured with 2 strands of the tie wire. Barbed wire shall be galvanized, four strand of 12 gauge wire, with 4-point, 14 gauge, round barbs spaced not more than 12.7 cm. on centers. Tie wire for attaching barbed wire to fence posts shall be 12 gauge, galvanized, soft steel wire.

30.5.1 Fence Posts shall be pre-cast reinforced concrete with smooth finish exposed surfaces. Posts shall be set in concrete as shown. The concrete shall be thoroughly compacted by rodding, and shall be finished at the top in a dome shape to drain off water. The concrete base shall be allowed to cure for 48 hours before any further work is done on the posts.

30.6 Cattle Guard shall be constructed of materials, size and shape as shown. Steel pipes shall be galvanized, 2 inches diameter, schedule 80, extra strong and welded to galvanized steel angle and frames. End frames shall be connected to galvanized steel angles by anchor bolts embedded in concrete. Steel angles shall be attached rigidly to concrete support by 1/4-inch diameter anchor legs as shown. All steel frames and anchor bolts and legs shall be galvanized and of the sizes and dimensions as shown. Cattle guard shall be provided with a drain and shall be installed as shown. All metalwork shall conform to the applicable specifications of section entitled Miscellaneous Metal Work. Concrete work shall conform to the requirements of section entitled Concrete Work.

- End of Section -

SECTION 31 - SOIL TREATMENT; TERMITES

31.1 General Requirements: The work includes the furnishing of all plant, labor, equipment, appliances and material to provide termite protection complete, in strict accordance with the specifications and applicable drawings, and subject to the terms and conditions of the contract.

31.2 General:

31.2.1 Building with Concrete Floor Slab on Fill: The work will consist of treating the soil around and adjacent to the foundation and beneath the concrete floor slab of buildings having a floor slab on fill, to provide a chemical barrier that will give complete protection from subterranean termite attacks.

31.3 Materials: Insecticides will be delivered to the job in the original sealed manufacturer's container. The designated name, formula or specification number, manufacturer's name, direction for diluting and precautions to be taken for storing, mixing and applying will be plainly legible at the time of use. All diluting will be done in the presence of the Contracting Officer or his representative. Any of the following materials may be used at the option of the contractor:

31.3.1 Chlordane - 1.0% in a water emulsion

31.3.2 Aldrin - 0.5% in a water emulsion

31.3.3 Dieldrin - 0.5% in a water emulsion

31.3.4 Heptachlor - 0.5% in a water emulsion

31.4 Options: - Where choice of materials or methods is stated herein as being optional, the Contractor may exercise such options with the approval of the Contracting Officer.

31.5 Samples: When deemed necessary by the Government, the Contractor shall submit one-pint samples of soil poison to the Contracting Officer.

31.6 Application: Just prior to placing concrete floor slab soil poisoning shall be applied. Under slabs on fill, 1 1/2 gallons per 10 square feet as overall treatment after the final grading and compaction, and just prior to placing the

vapor barrier and just before the slab is poured. In critical areas such as at expansion joints, around utility opening for pipes, conduits, and ducts, 2 gallons per 5 linear feet in a strip 1-foot wide. Along the exterior perimeter of the slab, 2 gallons per 5 linear feet in a strip one foot wide in shallow trench.

31.7 Application Conditions: Soil poisons will not be applied when the soil is too wet to permit ready absorption of the solution.

31.8 Safety: Special care will be exercised to prevent accidental poisoning of humans or pets by pesticides and to prevent damage by pesticides to vegetation and other objects. All pesticides or other toxicants will be secured under lock and key whenever they are left unattended whether in vehicle or shop. No pesticides or emptied containers thereof will be dumped or left unattended in any place, nor disposed of in a manner likely to cause injury. Containers will be crushed and placed directly into the sanitary fill or removed from the installation. They will not be placed in dumpsters or trash cans. Under no circumstances will pesticides be left with the building occupants.

- End of Section -

SECTION 32 - PAINTING

32.1 General Requirements: The work includes the providing of painting, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

32.2 Applicable Specifications and Standards:

32.2.1 Federal Specifications:

TT-P-0019	Paint; acrylic emulsion, exterior
TT-E-489c(3)	Enamel; alkyd gloss (for exterior and interior surfaces)
TT-P-21(2)	Paint; cement-water, powder, white and tints (for interior and exterior use).
TT-P-56b	Primer coating (primer sealer), pigmented oil, plaster and wall board.
TT-P-25a(1)	Primer, paint, exterior (under-coat for wood, ready-mixed, white and tints).
TT-P-86a	Paint; red-lead base, ready-mixed.
TT-P-102(2)	Paint (titanium-lead-zinc, and oil, exterior, ready-mixed, white and light tints).
TT-P-64lb	Primer, paint; zinc dust - zinc oxide (for galvanized surfaces).

32.3 Materials:

32.3.1 Primer for Ferrous Metals shall be red-lead base paint conforming to Federal Specification TT-P-86c.

32.3.2 Varnish for Natural Wood Finish shall conform to Federal Specification TT-V-121c(1).

32.3.3 Primer for Exterior Wood Surfaces shall conform to Federal Specification TT-P-25a(1).

32.3.4 Primer Coating shall conform to Federal Specification TT-P-56b.

32.3.5 Interior Oil Paint shall conform to Federal Specification TT-P-51d.

32.3.6 Primer for Galvanized Surfaces shall conform to Federal Specification TT-P-64lb.

32.3.7 Exterior Oil Paint shall be the titanium-lead-zinc and oil paint conforming to Federal Specification TT-P-102(2).

32.4 Samples: The contractor shall submit paint and color samples to the Contracting Officer and obtain approval prior to use.

32.5 Preparation of Surfaces: All dirt, dust, rust, scale, loose particles, disintegrated paint, grease, and foreign matter shall be removed from all surfaces which are to receive paint or other finish.

32.5.1 Interior Plaster Surfaces: All cracks and holes shall be repaired with patching plaster, properly keyed to the existing plaster and sandpapered smooth. Surfaces shall be dry, clean and free from dirt, loose plaster, and surface irregularities before paint is applied. Plaster to receive water-emulsion type paints shall be minimum of two weeks old.

32.5.2 Exterior Plastered Surfaces: Surfaces shall be dry brushed before painting. If effluorescence remains on surfaces, a diluted solution of muriatic acid (5 to 10 percent) may be used to wash surface. Following acid wash, the surface shall be thoroughly flushed with clear water to remove all acid.

32.6 Application: Paint shall be applied carefully with good clean brushes. Sufficient time shall be allowed between coats to permit thorough drying. Finish coats shall be smooth and free from runs, sags, or other defects. Each coat of paint shall be sufficiently heavy to cover completely the previous coat or surfaces. Color painting schedule shall be as approved by Contracting Officer.

32.6.1 Ferrous Surfaces, that have not been shop coated, shall be cleaned and given a prime coat of red-lead paint, followed by two coats of oil paint. Shop-coated metal shall be touched up with similar paint, if required, and given two coats of oil paint.

32.6.2 Galvanized Metal Surfaces, except fencing, shall be given a prime coat of zinc dust-zinc oxide primer and two coats of oil paint.

32.6.3 Interior Plaster Surfaces: All interior plaster and masonry surfaces to be painted shall be with one coat of an oil-type, pigmented wall sealer conforming to Federal Specification TT-P-56b and finished with one coat of a high-grade, synthetic-type, semi-gloss enamel conforming to Federal Specification TT-P-489c, Type A, thinned with 1 pint of mineral spirits or turpentine per gallon and followed by one coat of the semi-gloss enamel as received.

32.6.4 Exterior Wood Surfaces shall be cleaned, given one coat of exterior wood primer and two coats of exterior oil paint.

32.6.5 Interior Wood Surfaces shall be given two coats of interior oil paint.

32.6.6 Exterior Plastered Masonry shall be cleaned allowed to dry, and given two coats of exterior acrylic emulsion paint.

32.7 Markings: Cases of regulators, transformers, circuit breakers, relay cabinets and similar equipment shall be identified by stencil in white oil paint and worded as directed in English and Thai letters not less than 2 inches high.

- End of Section -

SECTION 33 - DIESEL ELECTRIC GENERATING UNITS

33.1 General Requirements: The work includes the installation of diesel generator sets, complete in strict accordance with the contract drawings and this specification.

33.2 Applicable Specifications and Standards:

33.2.1 AWS: (American Welding Society, 347 East 47th Street, New York 17, N. Y.)

B3.0-41 Standard Qualification Procedure.

D1.0-46 Standard Code for Arc and Gas Welding in Building Construction.

33.2.2 ASA: (American Standard Association 1951)

B31.1-1955 Code for pressure piping.

33.3 Equipment Installation: The contractor shall perform all operations of uncrating, removal of temporary protective coatings, assembly, setting in place in the location shown, levelling, anchoring, connecting, testing and adjusting for satisfactory operation of the Diesel Electric Generator sets, panel boards and all other components, or accessory equipment. The locations shown are subject to minor revisions by the Contracting Officer to avoid interference with other equipment utility lines or architectural features of the building. The location of electrical conduits, fuel lines, exhaust lines or other associated features will be confirmed in the field prior to installation to provide the most convenient accessibility to the connecting point of the machine. The contractor shall supply and install all connection boxes necessary to insure satisfactory installation and connections.

33.3.1 Piping: Unless otherwise shown or specified, all piping shall be installed in accordance with the applicable requirements of American Standard Code for Pressure Piping ASA B31.1-1955.

33.3.2 Gaskets: Gaskets shall be class I for fuel, lubricant, coolant and high temperature service. The gaskets for water and low temperature service shall be Class II. All gaskets shall be cut of one piece.

33.3.3 Welding, Gas and Electric: Welding and welding materials shall conform to the American Welding Society Code D1.0 - 46, and AWS Procedure B3.0-41.

33.3.4 Fuel and Lube Oil System: All fuel oil and lube oil piping on engines and within the building shall be pickled using a 25% muriatic solution or equivalent, neutralized and flushed clean prior to start up of a new engine or plant. Fuel oil and lubricating oil lines will be welded type steel. Copper tubing will not be used except when furnished with, and as an integral part of the engine. Pipe flanges and pipe fittings will be of the socket welding type. Socket welding unions will be used at threaded valves and socket welding flanges will be used at flanged valves. Flanged connections will be used to fullest extent, so that the piping valves and equipment may be isolated without disturbing the general piping system. The fuel oil supply and return lines will be flushed with No. 2 diesel oil. The lubricating oil supply and return lines will be flushed with light (#10 or equal) lubricating oil. The engine will be bypassed during flushing. Pumping capacity for flushing will be arranged to maintain a velocity of 10 to 20 feet per second. The flushing will continue for at least one hour after the flushing product becomes clean.

33.3.5 Cooling System: The entire cooling system to be flushed in accordance with manufacturer's specifications.

33.4 Tests:

33.4.1 General: After the diesel generator sets installation is completed, and at such time as the Contracting Officer may direct, the contractor shall conduct an operating test for approval. Engines shall be run continuously through the consecutive tests, to demonstrate engine performance within normal operating limits of engine temperatures and operating pressure in accordance with published instruction Manual data of the manufacturer, a copy of which will be furnished the Contracting Officer by contractor. The contractor shall furnish all labor and water rheostat or other artificial electrical load, except that electrical load which is already installed may be connected if considered suitable for test use by the Contracting Officer. Fuel, oil and water will be furnished by the Government. Starting time shall be approved by the Contracting Officer. Instrument readings shall be recorded at 60 minute periods for the following items.

- (a) Generator KW
- (b) Generator voltage
- (c) Engine speed (RPM)
- (d) Engine lube oil entering and leaving temperatures
- (e) Engine jacket water inlet and outlet temperatures
- (f) Engine exhaust temperature of each cylinder
- (g) Ambient temperature.

33.4.2 Run-In Period: The engine shall be run-in at a loading specified by the Contracting Officer for not less than 2 hours prior to the beginning of load test runs. During this time, all instruments, controls, temperatures and pressures shall be adjusted to normal and shall be so certified by the Contractor.

33.4.3 50% Rated Load Run: The engine shall be operated at 50% load for a period of 4 hours.

33.4.4 100% Rated Load Run: The engine shall be run at 100% load for a period of 4 hours.

33.4.5 110% Rated Load Run: The engine shall be run at 110% for a period of 2 hours.

33.4.6 Parallel Operation: Parallel operation test will be required where more than one generating unit is provided. Parallel operation test shall be conducted by running a full load test on all generators successfully for a period of four hours simultaneously within the speed and voltage specified in Military Specification 19826A(DOCK5). At the end of four hours parallel operation at 100% full load the load shall be reduced and equally shared by all engines as follows:

- (a) Run all engines 100% load for fifteen minutes.
- (b) Reduce engine No. 1 to 50% load and read just remaining engines until load is shared evenly, then run all engines at equal load for fifteen minutes.
- (c) Continue same test (a) and (b) above for each engine.

33.4.7 Upon completion of all load runs, the following safety controls and alarms shall be tested:

- (a) Increase engine speed manually and note RPM at which overspeed trip functions.
- (b) Adjust jacket water temperatures above normal and note temperature at which safety alarm functions.
- (c) During the shutting down sequence on each engine, note the pressure at which lube oil low pressure alarm functions.

33.5 Electrical Load: The contractor may use the electrical load of the facility by arrangement if available and/or shall furnish electrical dummy load as required for testing purposes.

- End of Section -

SECTION 34 - ANTENNA INSTALLATION

34.1 Scope: Contractor shall provide footings and anchors and erect government - furnished antennas as indicated.

34.2 Erection Supervisor: Contractor shall provide a competent English - speaking erection supervisor to direct the work of installing the antennas. All work shall be performed in the presence of and subject to the approval of a designated representative of the Contracting Officer.

34.3 Drawings: Government will furnish to the contractor complete installation instructions and drawings for the various antennas. Contractor shall keep a log of such materials furnished, and all drawings, instructions-books, erection tools, etc. furnished to the Contractor shall be returned to the Contracting Officer after the work is completed.

34.4 Erection Tools: Contractor shall furnish all hand tools and equipment required for erecting the antennas. Motorized equipment is not specifically required, but may be used. For erecting the larger steel towers, Government will furnish for Contractor's use, at Government's option, either tower-erecting jigs and booms for manual assembly or a suitable motorized crane with operator, as available. All lines, ropes, block and tackle etc. used by Contractor in the erection work shall be new and unused or in like-new condition. Government's representative may at any time direct the Contractor to replace defective or inadequate tools or equipment. Hand tools to be supplied by the Contractor shall include, but not be limited to:

Block and tackle sets,

2 ea. 200 ft. 1,000-pound rating

2 ea. 100 ft. 1,000-pound rating

Surveyor's transit, rods and tapes

Dynamometers for measuring guy tension, 3 ea.

Miscellaneous hand lines, tools, etc., including fixed-gage wrenches (adjustable wrenches shall not be used on towers or antenna assemblies).

34.5 Erection Accessories: All tools, erection accessories, spare parts etc. packed with antennas shall be returned to the Government. Where feasible, such materials shall be repacked in the original containers, or in other suitable containers, the container identified, and the contents itemized on a list submitted to the Contracting

Officer. Containers shall be stored as directed. Expendable crating materials and waste shall be removed from the site and disposed of as directed.

34.6 Correction of Damages: Contractors shall take care to avoid damaging antennas or components during erection, and particularly to avoid overstressing guys during tower erection and alignment. In case of damage to antennas or components, Contractor shall make repairs to the satisfaction of Government's representative, or replace the damaged material at his expense, as directed.

34.7 Wooden Fence shall be provided where shown. Pickets, 1 inch wide by 3 inches long and spaced at 0.15 m. on centers shall be nailed to wooden stringers, size 2 inches by 4 inches. Wood posts shall be 6 inches by 6 inches. Pedestrian gate shall be provided for each fence enclosure and shall be of the size as shown. Gate shall be hinged to gate post by a pair of butt hinges. Padlocking device shall consist of a 2-inch case size padlock and a heavy wrought brass hasp. A plastic radiation hazard sign, 0.30 m by 0.60 m. both in English and the local language shall be installed on each side of fence. Plastic plate shall be red etched with 1/4-inch yellow letters. Woodwork shall conform to the applicable requirements of section entitled Carpentry.

- End of Section -

SECTION 35 - PILING; REINFORCED CONCRETE, PRE-CAST

35.1 General Requirements: The work includes the providing of pre-cast reinforced concrete piles, as shown, complete, in strict accordance with the specifications and the applicable drawings, and subject to the terms and conditions of the contract.

35.2 Materials:

35.2.1 Concrete for Piles: Materials and mixing shall conform to applicable requirements of the Section: Concrete Work. The concrete shall have a compressive strength of not less than 3,000 pounds per square inch (210 kilograms per square centimeter) at 28 days. Coarse aggregate shall be well graded; maximum size shall be 1 1/2 inches.

35.2.2 Reinforcing Steel shall conform to applicable requirements of the Section: Concrete Work.

35.2.3 High-Early-Strength Portland Cement shall not be used.

35.2.4 Cast-Iron Shoes shall be made from iron melted by any process and cast to shape with 1 inch diameter plain steel bar therein not less than 20 inches long; the iron shall be of uniform quality and free from defects that would impair strength.

35.2.5 Forms shall be of wood, metal or other approved material. Forms shall be accurately constructed on unyielding bases to provide piles conforming to dimensions and shapes shown, shall be sufficiently tight to prevent seepage of cement from the mix and shall have sufficient strength to prevent distortion. Forms shall be constructed to permit independent casting; piles shall not be formed in tiers. The edges of square piles shall be chamfered not less than 1 inch. All forms shall be thoroughly cleaned and oiled with mineral oil before use.

35.3 Placing of Reinforcement: Reinforcement shall be constructed as shown, accurately placed, well secured and supported by concrete, metal spacers or metal hangers. Splicing shall be sufficiently lapped to transfer the stress between bars by bond and shear. Adjacent bar splices shall be staggered. Bars where lapped shall be spliced a minimum of 42 bars diameters and terminate with a hook unless otherwise shown.

35.3.1 Lifting Holes shall be formed by 1-3/4 inches diameter steel pipe extending transversely through the pile, and placed where shown. Lifting holes shall be accessible for moving piles into position for completion of curing.

35.4 Placing of Concrete shall start at the head of the pile and shall be carried to the tip. The entire unit shall be poured in a continuous operation. The concrete shall be mechanically vibrated in placing. Exposed surfaces shall be screeded to a uniform even surface and finished to match the other sides of the pile. Care shall be taken to produce straight piles with smooth surfaces of dense mortar and to retain the reinforcement in its proper position. Lifting points, as shown, shall be clearly marked on all piles. Each pile shall have the date of casting plainly indented into the concrete.

35.6 Curing: Piles shall be maintained in a wet condition for at least 7 days following casting, and shall be kept damp for not less than 7 days thereafter. Piles shall be protected from the sun and wind by a wet burlap. Side forms shall remain in place for at least 48 hours after pouring.

35.7 Supporting Points During Shipping: When shipping or moving, piles shall be supported at the lifting points marked on the pile.

35.8 Equipment: All plant, equipment, tools and machines shall be suitable for the use intended. Driving equipment shall be the type generally used in standard pile driving practice, and shall be subject to approval by the Contracting Officer.

35.8.1 Cushion: A cushion of approved design shall be used to preclude striking the ends of the reinforcing steel and shall be of material permitting excessive loss of hammer energy.

35.9 Driving Piles:

35.9.1 General: No piles shall be driven within 100 feet of structural concrete less than 7 days old and until the concrete has attained the minimum compressive strength specified. Piles shall be carefully located to the lines and spacing shown and shall be driven plumb. The top of piles shall not be more than 8 cm. out of place. The deviation from the vertical shall not be more than 1/4 inch per foot of pile length.

35.9.2 Driving: Each permanent pile shall be driven without interruption to practical refusal or until the required penetration per blow has been reached, and this penetration per blow shall be determined by the formula as follows:

$$S = \frac{2 WH}{R} - 0.1 \frac{P}{W}$$

where,

- R = Allowable design load per pile in pounds
- W = Weight of hammer in pounds
- H = Fall of hammer in feet
- S = Average penetration in inches per last 10 blows
- P = Weight of pile in pounds

Driving shall be continued until plan cut-off is reached or until the rate of penetration specified is obtained. After driving, all piles shall be cut-off at plan cut-off elevation and the surplus material shall be removed from the site of work.

35.9.3 Slender Piles: When handling and driving long piles of a high slenderness ratio, special precautions shall be taken to insure against overstress or loading away from a true or plumb position when driving.

35.9.4 Water Jets may be used in driving only when specifically authorized. All jetted piles shall be seated by final driving to the resistance required.

35.10 Test Piles shall be of the same size and materials as the permanent piles and shall be driven with the same equipment and in the same manner as specified for such pile. Test piles shall be driven in advance of final driving of permanent piles so that lengths for costing may be determined.

35.11 Damaged or Mislocated Piles or piles driven out of alignment shall be withdrawn and replaced by new piles all without additional cost to the Embassy.

35.12 Price Adjustment in the contract price and for the time for completion shall be made if splicing is deemed necessary. No price adjustment will be made for cutting off piles.

35.13 Record of Driving: A complete report of each pile driven shall be made and delivered to the Contracting Officer. This report shall contain all dimensions, elevation points, and elevation of butt before and after cutting off. The record shall include the average penetration of each pile under the last 10 to 20 blows where steam hammers are used, or the last 5 to 10 blows where drop hammer are used.

- End of Section -

Attachment No. 1
Transmitter Facilities

A1 LIST OF DRAWINGS ACCOMPANYING SPECIFICATIONS

A1.1 Drawings Accompanying Specifications: The following drawings accompany this specification and are deemed a part thereof. Drawings are the property of the Government, and shall not be used for any purpose other than that contemplated by the specifications.

<u>Drawing No.</u>	<u>Title</u>
TTF - C1	Cover Sheet - Index of Drawings, Site Plan, Location and Vicinity Maps
TTF - CE2	Site Development and Utilities - Plan "A"
TTF - CE3	Site Development and Utilities - Plan "B" and Boring Log
TTF - C4	Site Development and Utilities - Access Road and Building Compound - Detail Plan
TTF - C5	Site Development and Utilities - Miscellaneous Details
TTF - C6	Access Road and Building Compound - Profiles, Sections and Details
TTF - CS7	9,000 gal. Elevated Water Storage Tank - Plan, Sections, Elevations and Details
TTF - C8	Security Fence and Gate - Elevations, Sections and Details.
TTF - C9	Cattle Guard and Perimeter Fence - Plan, Sections, Isometric and Details
TTF - A1	Transmitter Bldg. - Plan, Elevations, Sections and Schedule
TTF - A2	Power Plant - Plan, Elevations, Sections and Schedule
TTF - A3	Typical Details - Wall Sections

<u>Drawing No.</u>	<u>Title</u>
TTF - A4	Typical Details - Wall Sections
TTF - A5	Typical Details - Miscellaneous Details
TTF - A6	Typical Details - Schedule and Details of Doors
TTF - A7	Typical Details - Schedule and Details of Windows and Louvers
TTF - AS1	Guard House - Plans, Elevation, Section and Details
TTF - S1	Transmitter Bldg. - Plans, Sections and Details
TTF - S2	Power Plant - Plans, Sections and Details
TTF - S3	Antenna Foundations - Plans, Sections and Details
TTF - S4	Antenna Foundations - Plans; Sections and Details
TTF - S5	Soils - Boring Location and Logs
TTF - M1	Transmitter Bldg. - Plan, Sections, Details and Isometric
TTF - M2	Power Plant - Plan, Section and Isometric
TTF - M3	Power Plant - Flow Diagram, Sections and Details
TTF - E1	Transmitter Bldg. - Lighting and Power Plan
TTF - E2	Transmitter Bldg. - Power , Signal and Antenna Cable Tray
TTF - E3	Power Plant Bldg. - Power and Lighting Layout
TTF -E4	Power Plant Bldg. - Switchgear : Detail and One-Line Diagram
TTF - E5	Site Works - Grounding and Feeder Layout

<u>Drawing No.</u>	<u>Title</u>
TTF - E6	Riser Diagram - Guard House Plan and Details
TTF - TE1	Lighting Fixture Details
TTF - TE2	Typical Details - Pre-cast R.C. Pole
TTF - TE3	
TTF - TE4	

- End of Attachment No. 1 -